Regency® ELECTRONICS INC.

SERVICE MANUAL

MODEL MICRO COM U11B, U14B

UHF FM TRANSCEIVERS

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MICRO-COM U11B and MICRO-COM U14B
SERVICE MANUAL

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SECTION I

GENERAL INFORMATION

SECTION 1 GENERAL INFORMATION

1-1 DESCRIPTION

The Regency MICRO-COM U11B and MICRO-COM U14B are FM Base Station transceivers designed for use in the UHF, 450 to 470 MHz, Land Mobile Communications bands. The U11B and U14B are respectively, one and four channel versions of the same transceiver design.

Continuous Tone Squelch Circuitry is available as an option with all of the series. The tone squelch option provides for channel monitoring, which is initiated by an auxiliary switch on the microphone.

The receiver section is certified under Part 15, Subpart C of the FCC Rules. The transmitter is Type Accepted under the following FCC Rules parts:

21 Domestic Public Radio Services
89 Public Safety Radio Services
91 Industrial Radio Services
93 Land Transportation Radio Services
95 Citizens (Class A) Radio Services

1-2 SPECIFICATIONS

RECEIVER

Antenna Impendance	50 Ohms
Channels	
MICRO-COM U11B	1 Crystal Controlled
MICRO-COM U14B	4 Crystal Controlled
Frequency Range	450-470 MHz
Maximum Channel Spacing	1.0%, with 3 DB degradation
Sensitivity	.35uV, 12 DB Sinad .50uV, 20 DB Quieting .25uV, Carrier Squelch Opening .25uV, Tone Squelch Opening
Selectivity	75 DB @ 26 KHz
Spurious and Image	75 DB

Intermodulation Rejection	70 DB
Modulation Acceptance	±7.5 KHz
Frequency Stability	±.00025%, -30°C to +60°C
Audio Response	Within plus 2 and minus 8 DB from a standard 6 DB per octave de-emphasis curve over the frequency range of 300 to 3000 Hz with a 1,000 Hz reference frequency
Audio Output Power, Rated Value	4 watts @ 5% distortion
Maximum Audio Output Power	5 watts @ 10% distortion
I.F. System	Double Conversion 10.7 MHz - 455 MHz
Part 15 FCC Certified	

TRANSMITTER

Antenna Impedance	50 Ohms
Channels	
MICRO-COM U11B	1 Crystal Controlled
MICRO-COM U14B	4 Crystal Controlled
Frequency Range	450-470 MHz
Channel Spacing (1 DB power degradation)	6 MHz
Power Output	10 Watts (minimum)
Output Frequency Stability	±.00025%, -30°C to +60°C
Spurious & Harmonic Rejection	60 DB
Power Unit Protection	Temperature Limiting Power Control Circuit
Emission	16F3
Microphone	High Impedance Plug-in Ceramic

Modulation..... Frequency Modulation with Automatic Deviation Limiting

Deviation..... Factory Adjusted to ±5 KHz (max.)

Audio Frequency Distortion 10%

FM Hum and Noise Level..... -60 DB

Audio Frequency Response.... From 300 to 3000 Hz, within +1 and -3 DB of a 6 DB per octave pre-emphasis characteristic as referred to the 1,000 Hz level

POWER

Power Requirements..... 117 AC, 60 cycles (nominal)

Receive Condition..... .15 Amps

Transmit Condition..... .8 Amps (max.)

Fuse Size..... 2 Amps,3AG

GENERAL FEATURES

Front Panel Size..... 3 5/8" x 12"

Depth (Including Knobs)..... 8 3/4"

Weight (Complete)..... 12 1/2 Lbs.

Speaker..... 3 1/2" Square, 3.2 Ohm Impedance

1-3 EQUIPMENT SUPPLIED

1 - Transceiver unit
1 - Microphone and Connector
1 - AC Power Cord
1 - Owner's Instruction Manual

1-4 EQUIPMENT NOT SUPPLIED

1 - Antenna
1 - Coaxial Cable feedline
1 - Coaxial Cable connector

1-5 INSTALLATION

The antenna used should be of a design to properly match the 50 ohm output of the transmitter. A high SWR will decrease the power output of the transmitter, and impair the sensitivity of the receiver. The antenna installation and its cable should be checked with a SWR bridge.

A connector socket is provided for the use of an external loudspeaker. The use of a 3 to 4 ohm speaker is recommended for best performance. (Regency Electronics, Inc., Auxiliary Speaker Model MA-8) The internal loudspeaker connections are on pins #1 and #2 of the external loudspeaker plug.

1-6 OPERATION

On-Off Switch:

The power On-Off switch is located in the upper center portion of the front panel. The switch is of the Push On-Push Off variety.

Volume Control:

The volume control is of the slider type. Sliding the knob upward increases the volume, sliding it downward decreases volume. The volume control affects only the volume of received signals as heard in the loudspeaker. It does not affect the volume of the transmitted signals.

Squelch Control:

This control eliminates background noise in the absence of a signal. Sliding the knob all the way down removes all squelch action. Sliding the knob upward until the noise disappears permits the receiver to be quiet until an actual signal is received. Best performance is obtained when the squelch control is adjusted in the quiet portion of its travel, just adjacent to the point at which the noise appears.

In units equipped with Tone Squelch, the "Monitor" bar on the microphone must be held down while adjusting the squelch control.

An improperly adjusted squelch control, i.e., with the control adjusted too far into the quiet portion of its travel, can cause the receiver to miss some weak signals.

Tone Squelch Monitoring Function: (For units equipped with Tone Squelch)

When the "Monitor" bar on the microphone is in the "up" position, the Tone Squelch System is effective and only signals from stations having the appropriate tone will be heard.

On shared radio channels, it is considered good manners to listen on the channel before transmitting. When the "Monitor" bar on the microphone is held down, the Tone Squelch circuits are placed in the MONITOR condition, and any signal on the channel will be heard regardless of whether it has the appropriate tone coding.

Consequently, you should press the "Monitor" bar down, and listen to the channel for a moment before transmitting, to assure yourself that someone else is not using the channel.

U14B Channel Selector Buttons:

The U14B is capable of two-way communications on multiple discrete, crystal-controlled frequencies, or channels. Selection of the desired channel is accomplished by pressing the corresponding channel selector button on the front panel of the unit. The radio will neither receive nor transmit unless one of these buttons is depressed.

NOTE: DO NOT push more than one channel selector switch button at a time.

Indicator Lamps:

Two pilot lamps are located on the front panel of the unit. The Green pilot lamp indicates whether the unit is turned on or off. The Red Lamp glows whenever the transmitter is keyed on (activated).

Microphone:

A high-impedance, desk style, ceramic microphone is supplied with the unit. To install the microphone on the radio set, insert the connector plug into its socket in the front of the radio, and lock it into place by rotating the locking ring ¼ turn clockwise.

To transmit a message, it is only necessary to press the Transmit button on the microphone and speak into the microphone.

The Transmit Indicator will come on to signify that the transmitter is operating.

Best results are obtained by holding the microphone about one inch from the lips, inclined at about a 30 degree angle away from the face. Speak clearly in a normal tone of voice across the face of the microphone.

1-7 CRYSTAL SPECIFICATIONS

Miniature plug-in crystals are utilized in both the receiver and transmitter sections.

The following Regency Part Number crystals are used:

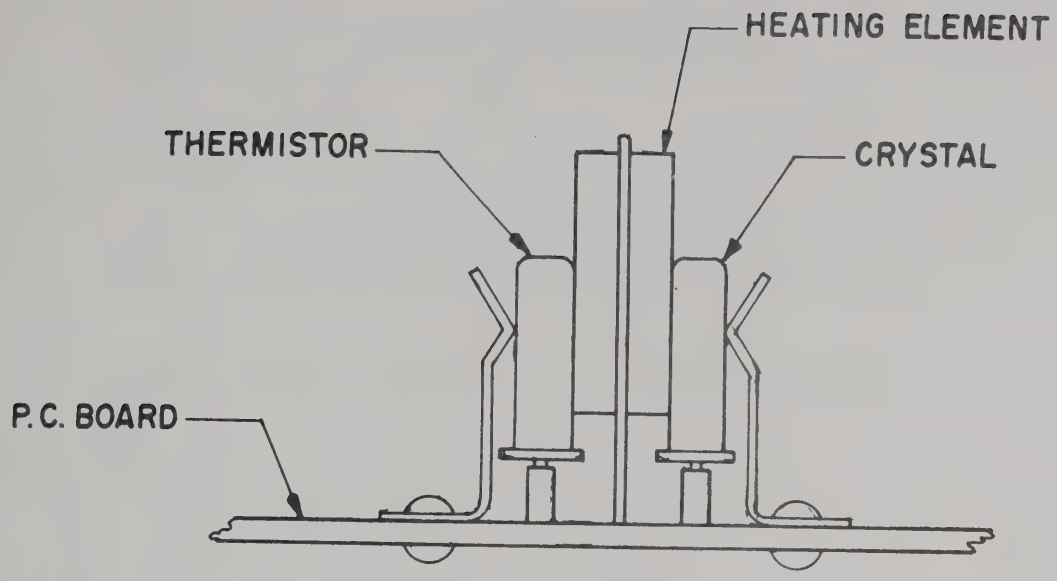
Transmit Crystals:	302-539
Receive Crystals:	302-540

Crystals should be ordered by specifying the above part numbers and the exact channel frequency required.

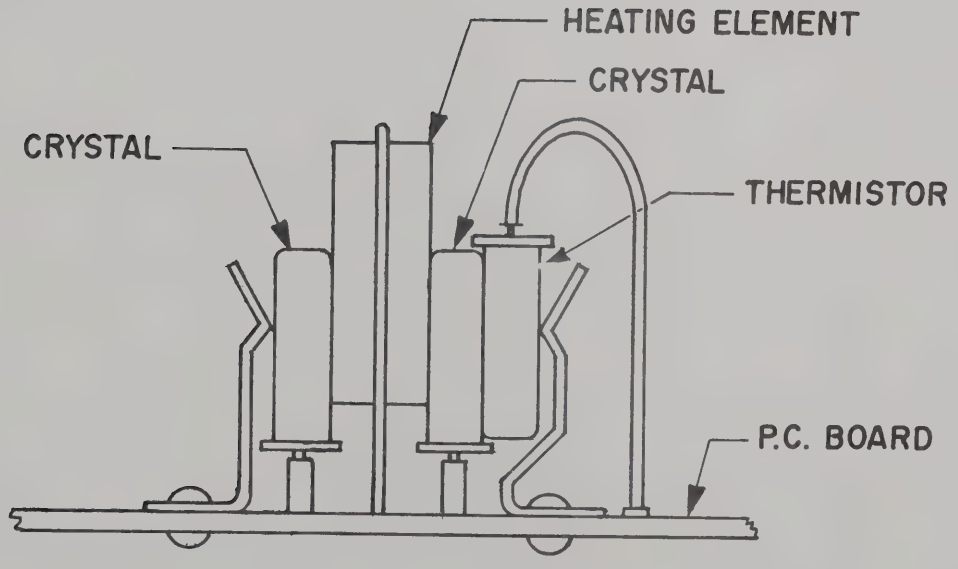
Installation of crystals requires the services of a competent technician with appropriate test equipment. Instructions for the necessary adjustments are included in the receiver alignment and transmitter tuning procedures later in this manual.

1-8 CRYSTAL INSTALLATION

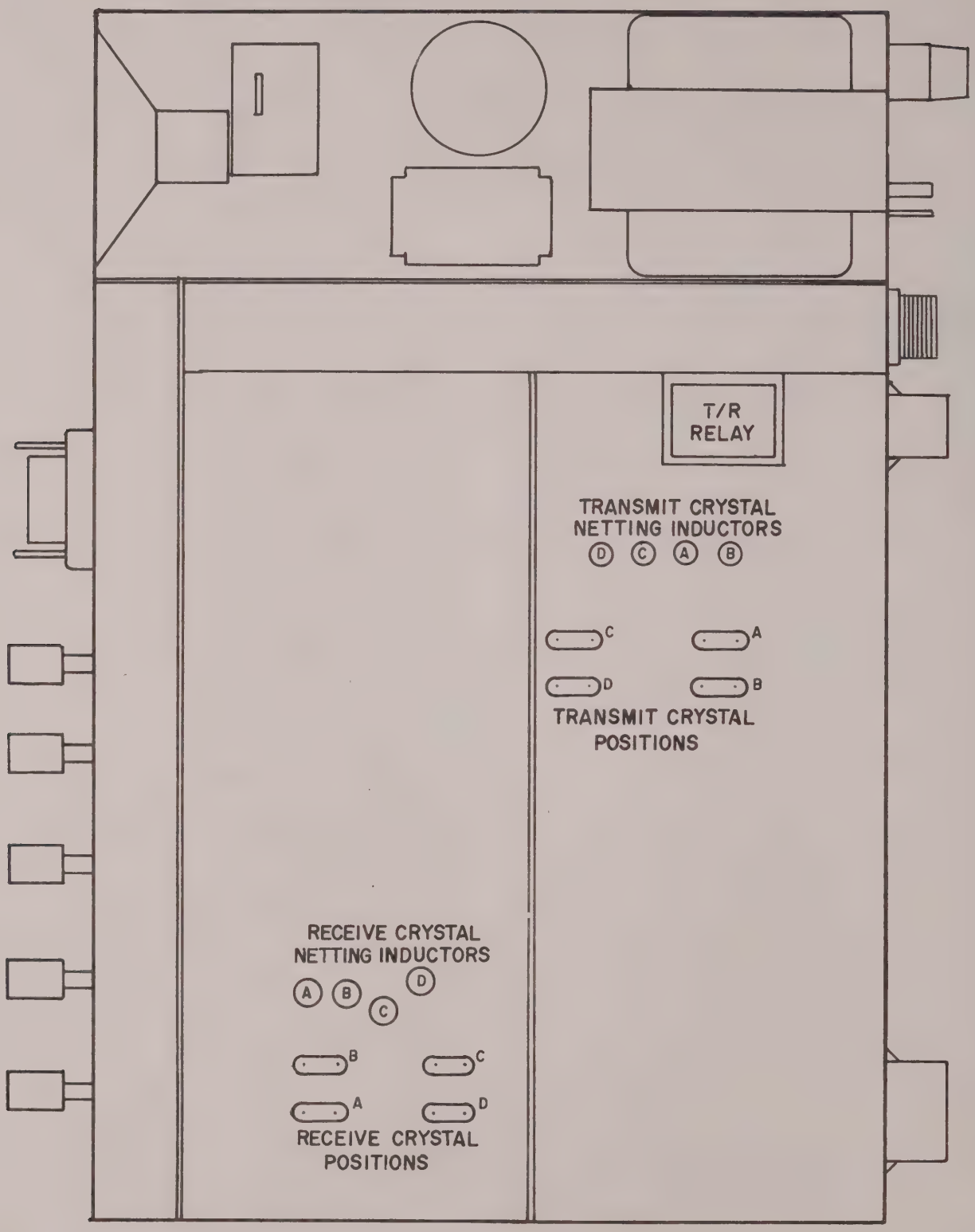
Special care must be taken to install the crystals correctly. The conduction type crystal heater which is used to warm the crystals at low ambient temperatures relies on having proper physical contact between the heater element and the crystal for effective operation. The Crystal Heater Detail, (Figures 1-9,1-10) demonstrates the correct method of crystal installation. The crystal must be pressed down into the socket pins far enough for the rim around the bottom of the crystal to clear the heating element and allow good contact between the side of the crystal and the element.



1-9 CRYSTAL HEATING DETAIL U11B



1-10 CRYSTAL HEATING DETAIL U14B



I-11 CRYSTAL LOCATION AND ADJUSTMENT DIAGRAM
(WRAP REMOVED)

SECTION 2

CIRCUIT DESCRIPTIONS

SECTION 2 CIRCUIT DESCRIPTION

2-1 RECEIVER BOARD

The entire receiver is mounted on the receiver circuit board. The antenna is connected to a 2 Section RF Helical Filter, L109 and L110, which acts as a preselector for incoming signals.

Q105 is a grounded gate, low noise, J-FET amplifier. Its output is fed through an additional 2 Section Helical Filter, L112 and L113 and delivered to the gate of Q106, J-FET mixer.

L.O. (Local Oscillator) injection for the J-FET mixer Q106 is at a frequency of 10.7 MHz lower than the incoming signal frequency. It is obtained from a crystal oscillator-multiplier chain, consisting of Q101, Q102, Q103, and Q104. Q101 is a crystal oscillator, using third overtone crystals in the 48.8 to 55.7 MHz range. In multi-frequency units, the active crystals are selected by the use of switching diodes CR102A, B, C, and D. The output circuit of Q101 oscillator is tuned to the third harmonic of the crystal frequency, and this harmonic is amplified by a buffer-amplifier consisting of Q102 and Q103. Q103 drives Q104, which operates as a frequency tripler, providing the wanted local oscillator injection frequency. This wanted injection frequency is separated from various harmonics and subharmonics by the L114 and L115 section of the helical filter and delivered to the source of the mixer, Q106.

The output of Q106 consists of a 10.7 MHz IF signal which is fed to a six-pole monolithic crystal filter, consisting of FL101, FL102, and FL103. This filter provides most of the adjacent channel selectivity of the radio. The signal is then amplified by integrated circuit, IC101, and fed to integrated circuit, IC102, which contains another amplifier for 10.7 MHz, the second mixer circuitry and the second L.O. circuitry, operating at 10.245 MHz.

The 455 KHz output of IC102 (terminal 5) is coupled through a tuned circuit to the input of the ceramic filter, FL104. FL104 is a narrow-band filter centered at 455 KHz, and it provides additional adjacent channel rejection. The output of FL104 is amplified and coupled through a tuned circuit to the input of integrated circuit IC103. IC103 is a series of amplifiers providing approximately 60 DB gain at 455 KHz. Also included in IC103 is the limiting circuitry and a quadrature detector circuit. L123, connected between terminals 2 and 12 of IC103, is the adjustable quadrature coil.

The audio output from IC103 (terminal 1) is coupled to the input of the audio amplifier circuit and to the input of the noise-operated squelch circuit.

Transistor Q110 is an amplifier whose frequency response extends from approximately 4 KHz to 25 KHz. Q110 amplifies the noise occurring in this frequency range. The noise is coupled to the base of Q111. Q111 is used as a detector which rectifies the amplified noise and produces a DC voltage at its collector. When the DC voltage at the collector of Q111 is positive and of sufficient value to provide base bias for Q112, Q112 turns on and provides essentially a short circuit between the emitter and base of Q113 thereby squelching the audio output from the receiver. When a signal carrier arrives, the noise input to the detector (Q111) is reduced to the point where the DC voltage at the base of Q112 is no longer sufficient to cause Q112 to conduct.

At this time, Q113 is allowed to conduct normally and the audio output of the unit is heard. With the audio preamplifier (Q113) operating normally, audio is applied through the volume control to the input of the audio amplifier, IC104. Q113 supplies a signal to the audio amplifier IC104, which amplifies the audio to loudspeaker level.

2-2 TRANSMITTER BOARD

AUDIO SECTION

Integrated Circuit IC201 (sections A and B) constitutes the audio circuitry of the transmitter. IC201A provides a high impedance input for the ceramic microphone, and supplies pre-emphasis and amplification prior to the modulation limiting circuit which consists of CR210 and CR211. IC201B provides additional amplification, and acts as an active filter to provide the post-limiter filter action. The output of IC201B is fed to a control potentiometer which controls the audio voltage sent to the modulator section and, therefore, is used to set the peak modulation deviation of the transmitter.

IC201B also provides an amplified input to feed tones for continuous tone squelch systems, or other tone systems, into the transmitter modulation circuits.

CRYSTAL OSCILLATOR

Q201 serves as the crystal oscillator, using crystals at 1/36 of the channel frequency. The crystals are fundamental cuts,

in the frequency range 12.5 to 14.3 MHz.

In multiple channel radios, the appropriate frequency is chosen by applying a positive voltage to the appropriate switching diode, CR202A, B, C, or D.

Direct frequency modulation of the crystals is obtained by applying the modulation signals from the audio section to varactor modulator diodes, CR201A, B, C, and D.

FREQUENCY MULTIPLIER SYSTEM

The output of the crystal oscillator, Q201, is tuned to three times the crystal frequency, and this signal is amplified by buffer-amplifier Q202, then delivered to the tripler circuit, Q203, then delivered to the doubler circuit Q204. Q204 drives another doubler, Q205, to obtain a combined frequency multiplication of 36 to reach the channel frequencies from 450-470 MHz. The doubler Q205 develops about 150 milliwatts of power to drive the power output module IC501.

POWER OUTPUT SECTION

The packaged power output module, IC501, contains three cascaded stages of power amplification. Its gain, and therefore its power output, can be controlled over certain limits by the power control circuit consisting of R227 and Q206, which varies the DC voltage input to one of the early amplifier stages. In normal operation, R227 is adjusted to provide the rated output from the transmitter, but it can be set for reduced power operation for special applications. In order to protect the power module from possible damage through overheating, a thermal protection circuit is included. RT201 is a thermistor that rapidly increases in resistance as its temperature reaches certain levels. RT201 is attached to one of the mounting bolts on IC501. When the temperature approaches excessive levels, RT201 increases in resistance, thereby reducing the voltage supplied to IC501 by the power control circuit.

2-3 REGULATED POWER SUPPLY CIRCUIT DESCRIPTION

The circuit diagram of the power supply is shown as a part of the overall transceiver schematic, in Section 4.

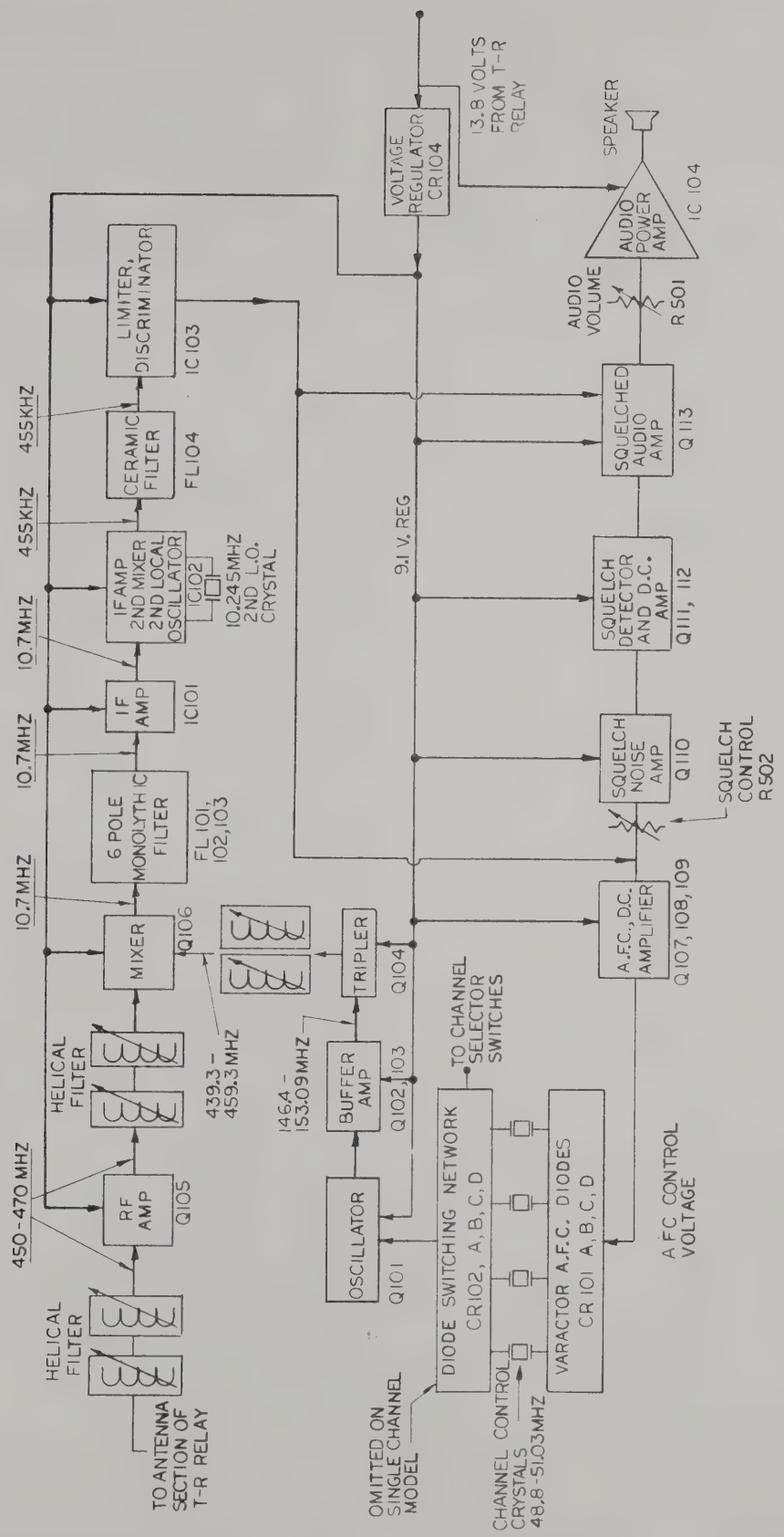
The power supply transformer T501 transforms the 117 VAC line voltage to 38 VAC, center tapped, at the secondary. Rectifiers CR501, CR502, CR503, CR504 and filter capacitor C503, rectify and

filter this secondary voltage to produce approximately 23 VDC which is reduced to 13.0 VDC by the series-pass regulator transistor Q501. CR501, CR502, and C502 provide a separate 23 VDC supply for the Regulator Board Circuitry.

The regulator circuitry operates as follows:

R404, R405, and R406 divide Q501's output (emitter) voltage down to a sample voltage slightly higher than that of CR401. Q402 continuously compares this sample voltage with the reference voltage of CR401 and adjusts the drive through amplifier Q401 to the regulator transistor Q501 accordingly.

As an example, assume that the radio set (load) increases the current drain on Q501, causing the output voltage, and consequently the sample voltage, to drop slightly. The reduction of base-emitter voltage of Q402 would cause a slight decrease in collector current which in turn would increase drive to Q401 (through R402). Q401 would then increase the base current to Q501 causing it to supply more current to the load and raise the output voltage slightly. In this manner an equilibrium is reached. Potentiometer R405 allows adjustment of the output voltage which is normally set for 13.0 VDC under Receive (standby) conditions.



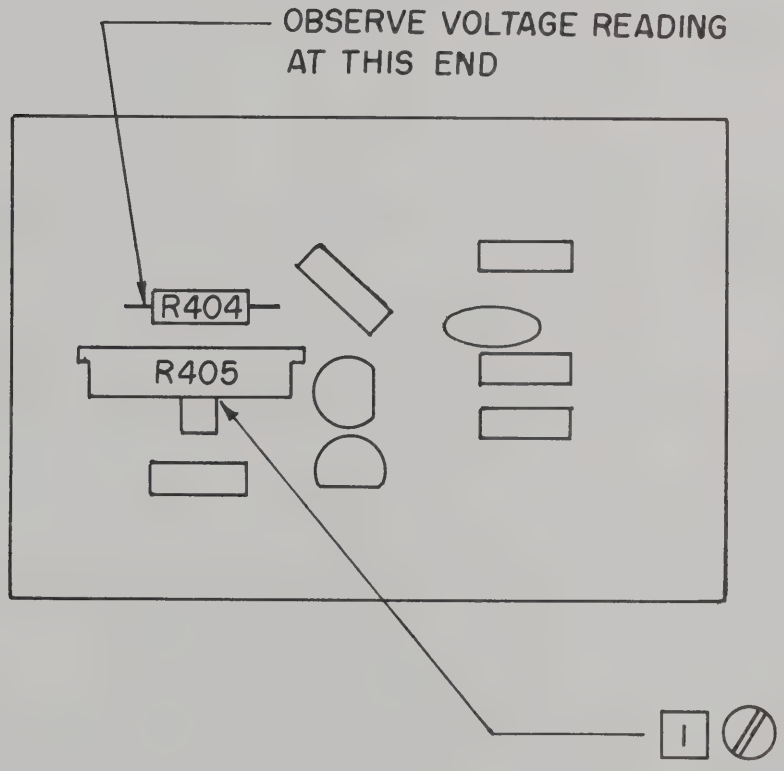
2-4 RECEIVER BLOCK DIAGRAM

2-5 TRANSMITTER BLOCK DIAGRAM

SECTION 3

ALIGNMENT & TUNING PROCEDURES

REGULATED VOLTAGE SUPPLY ADJUSTMENT PROCEDURES During Adjustment, Do NOT Press The Transmit Key On The Microphone			
SIGNAL SOURCE	OBSERVE	ADJUST	EXPECTED READING AND NOTES
None Required	Indicated End of R404, Use DC VTVM	#1 Adjust R405 To Obtain 13.0 VDC At Indicated End Of R404	This Adjusts Output of Voltage Regulator Under Receive (Standby) Conditions



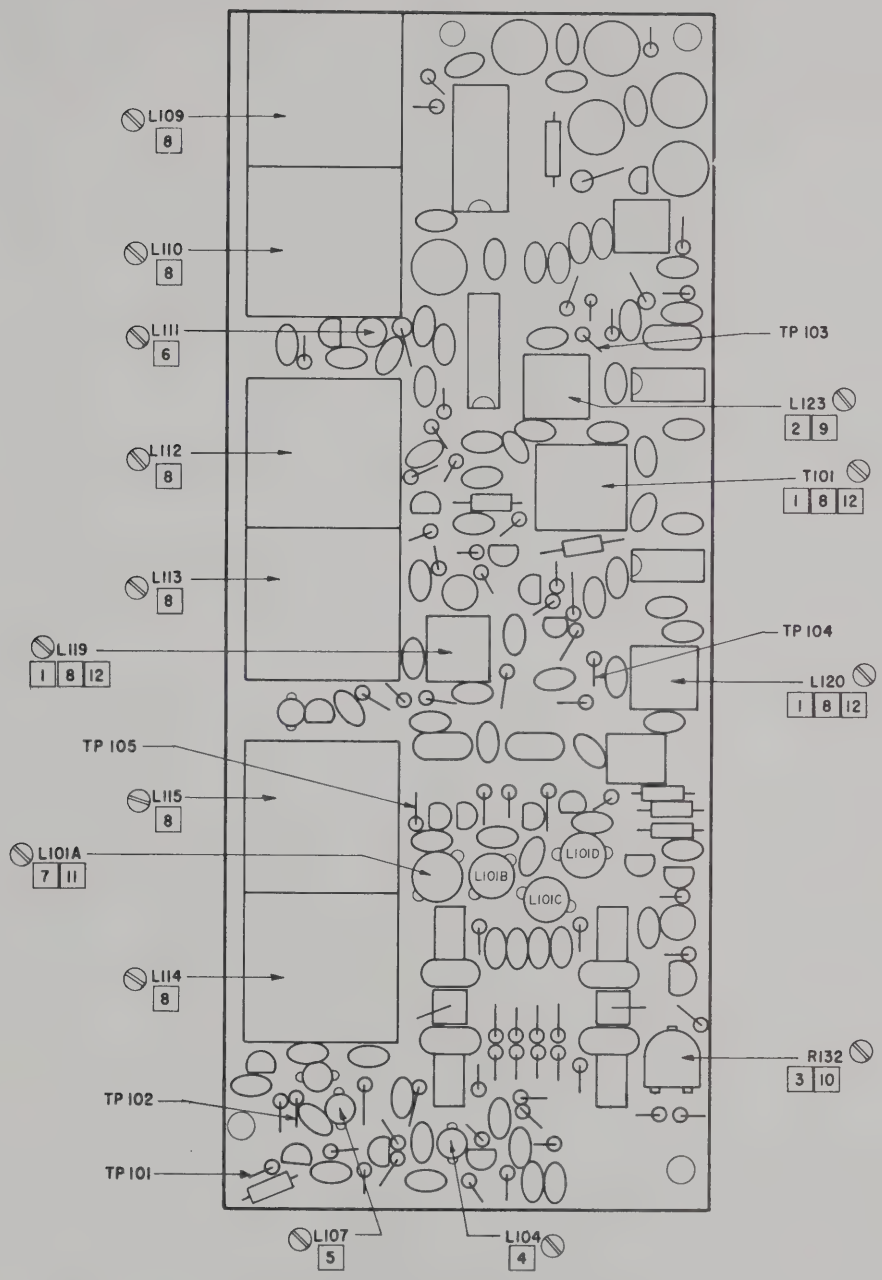
3-1 REGULATED VOLTAGE POWER SUPPLY ADJUSTMENT

RECEIVER ALIGNMENT PROCEDURE

During the receiver alignment procedure, set the squelch control to maximum counter clockwise position, (i.e.,unsquelched). Set volume control to comfortable listening level. Listening to received 1,000 cycle tone during the alignment procedure helps to avoid alignment errors.

	Signal Source	Observe	Adjust	Expected Reading, Notes
Preliminary I.F. alignment. Not necessary if radio has not been badly misaligned.	10.7 MHz Signal Generator, unmodulated. Connect Signal Generator to Drain of Q106, using a series 10,000 ohm resistor.	TP103, using DC VTVM	#1 Adjust L119, L120, T101 (top and bottom slugs) for maximum TP103 voltage.	Adjust signal generator output level to obtain a .3 volts positive reading at TP103. As alignment progresses, reduce signal level to maintain the .3 volts reading.
		TP104, using DC VTVM	#2 Adjust L123 to obtain a +4.5 volts reading at TP104.	This is a discriminator adjustment. TP104 voltage should swing through the 4.8 volts value as L123 is tuned.
		TP105, using DC VTVM	#3 Adjust R132 to obtain +4.0 volts reading at TP105.	This adjusts output of AFC amplifier to be at +4.0 volts when receiving an on-channel signal.
	None Required	TP101, using DC VTVM	#4 Tune L104 for minimum positive or maximum negative reading on TP101.	0 to +.2 volts. +.3 volts indicates oscillator is not oscillating.
		TP102, using DC VTVM	#5 Tune L107 for maximum negative reading on TP102.	-.2 to -.4 volts.
			#6 If the channel frequency is below 467 MHz, set the aluminum core on L111 even with the top of the coil form. If the channel frequency is above 467 MHz, set the aluminum core on L111 all the way to the bottom of the coil form. Once set, it is not necessary to adjust L111 during the tuning procedure.	
	Signal generator source capable of being set to within ±.00025% of channel frequency. Set signal generator output channel frequency. Modulate generator with a 1000 Hertz tone, with ±3 KHz peak modulation deviation. On Multiple channel radio, do alignment on channel #1.	TP105, using DC VTVM	#7 Adjust L101A to obtain +4.0 volts reading on TP105.	This is the receiver frequency adjustment. TP105 reading should swing through the 5.0 volts setting as L101 is adjusted.
		TP103, using DC VTVM	#8 Adjust L109, L110, L112, L113, L114, L115, L119, L120, and T101 top and bottom slugs for maximum reading at TP103.	As alignment progresses, reduce signal generator output level to maintain about .3 volts output at TP103.
	Reduce signal generator output to zero signal. If generator attenuator does not permit signal to be reduced below receiver noise level, disconnect signal generator from antenna jack.	TP104, using DC VTVM	#9 Adjust L123 to obtain 4.5 volts reading at TP104.	This adjusts discriminator to center of receiver bandpass.
		TP105, using DC VTVM	#10 Adjust R132 to obtain +4.0 volts reading at TP105.	This adjusts AFC voltage to center value when no signal received.
	Bring signal generator attenuator up to a level that gives a good, quieting, signal. Be sure signal generator is accurately set to channel frequency.	TP105, using DC VTVM	#11 Adjust L101A to obtain +4.0 volts reading on TP105. On multiple channel receivers, repeat this in channels 2, 3, and 4, adjusting L101B, C, and D respectively.	This adjusts receiver local oscillator chain to proper center frequency.
(Optional) Final touch up for optimum sensitivity	Signal generator, as above, tuned to exact channel frequency, and modulated by a 1000 Hz tone, with a peak modulation deviation of 3 KHz.	Distortion meter, connected to loudspeaker terminals. Follow usual distortion meter procedures for setting null and level controls. If a distortion meter is not available, this step may be accomplished by observing the 1,000 cycle signal on the loudspeaker terminals with an oscilloscope, and tuning for least noise on the sine wave trace. Do NOT attempt to touch up the tuning by using an unmodulated signal and tuning for silencing; this will result in a peaked response from the crystal filter and poor weak signal performance.	#12 Adjust L109, L110, L112, L113, L114, L115, L119, L120, T101 (top and bottom).	During this procedure keep signal level from the signal generator at a value sufficient to obtain a -12 db(25%) reading on the distortion meter. Remember that this is a "touch up" type of adjustment. None of the adjustments should be moved more than a small amount from the setting previously obtained.
Final discriminator & AFC check	Signal generator, as above, be sure it has not drifted off channel.		#13 Repeat steps 2 and 3 with zero signal input. Repeat step 7 on each channel with a strong signal.	

3-2 RECEIVER ALIGNMENT CHART



3-3 RECEIVER ALIGNMENT LOCATIONS

TRANSMITTER TUNING

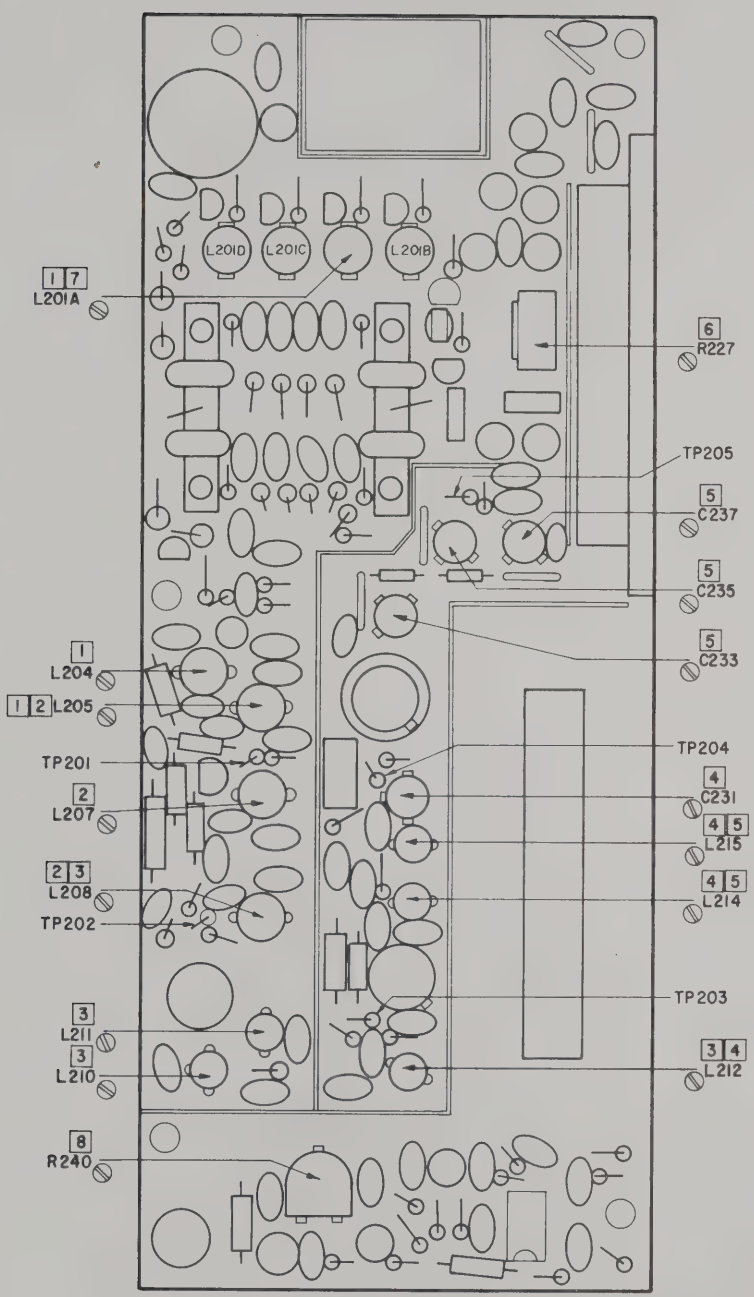
During Tune-Up Procedure, press the microphone button only when actually taking readings or making tuning adjustments. Until tune-up is completed, keep transmitter on time to a minimum.

Connect a 50 ohm load and R.F. wattmeter to the antenna terminal.

On multiple channel transmitters, conduct first tuning on highest frequency channel.

Test Meter	Observe	Adjust	Expected Reading
VTVM Ground lead on chassis Note: a 20,000 ohm per volt multimeter, on the 2.5 or 5 volts scale may be used for these proceedings. Readings will be 20% lower than those given here on 2.5 volt scale, and 10% lower on 5 volt scale.	TP201	#1 L201, and L205. L204 for minimum positive voltage reading (or maximum negative if TP2 goes negative).	+.55 volts, no drive +.4 to -.3 volts normal. A false peak on L205 is possible, look for biggest one.
	TP202	#2 L207 and L208 for minimum positive (or maximum negative) voltage reading. Then touch up L205 for maximum negative voltage reading.	+.5 volts, no drive +.25 to -.3 volts normal.
	TP203	#3 L210, L211, L212 for negative voltage reading. Then touch up L208 for maximum negative reading.	0 volts, no drive -.1 to -.4 volts normal.
	TP204	#4 L214, L215 and C231 for maximum negative reading. Then touch up L212 for maximum negative reading.	0 volts, no drive -.7 to -.9 volts normal.
	TP205	#5 C233, C235, C237 for maximum negative reading. Then touch up L214, L215, C235 for maximum negative reading.	0 volts, no drive -3 to -5 volts normal.
RF power meter, connected to antenna jack.	RF power output	#6 R227 to 10 watts output	10 watts normal.
	In multiple channel transmitters, if spacing between highest and lowest channel exceeds 3 MHz go back through all but the first step and tune for a compromise adjustment between the highest and lowest channel.		
Frequency meter, FM monitor or counter, with ± .00025% accuracy.	#7 Switch to channel #1 and adjust L201A to exact channel frequency. Then switch to channels 2,3, and 4, and adjust L201B, L201C, and L201D respectively to exact channel frequency. If either L201A,B,C,D have been changed appreciably during this step, go back and repeat the frequency setting on all channels.		
FM Modulation Monitor	#8 Inject a 100 millivolt (.1 volt) tone at 1,000 Hz into the microphone jack (pin #4 high, pin #1 ground), and adjust R240 so modulation deviation just reaches ± 5 KHz peak. Then, in CTCSS units, remove the 1,000 Hz tone and adjust R605 on the CTCSS board to obtain ±.75 KHz peak modulation deviation on the CTCSS tone. Reinsert the 1,000 Hz tone and adjust R240, so combined modulation peak deviation of the 1,000 Hz tone and the CTCSS tone is ± 5 KHz peak. If R240 was changed much, recheck the deviation due to the CTCSS tone alone, to be sure you still have .75 KHz peak deviation on CTCSS tone.		

3-4 TRANSMITTER TUNING CHART



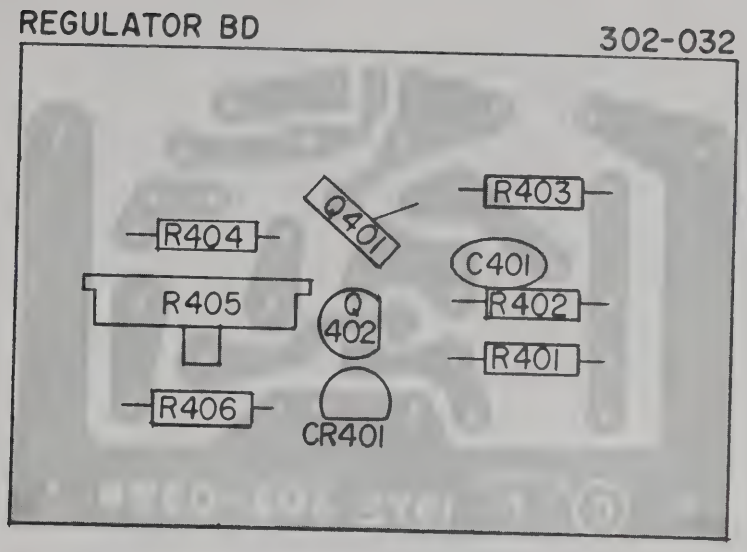
3-5 TRANSMITTER TUNING LOCATIONS

SECTION 4

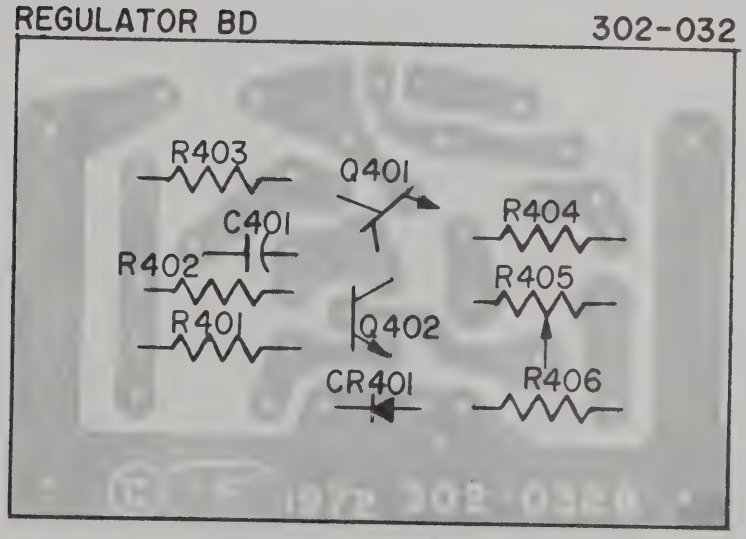
DIAGRAMS

VOLTAGE DATA

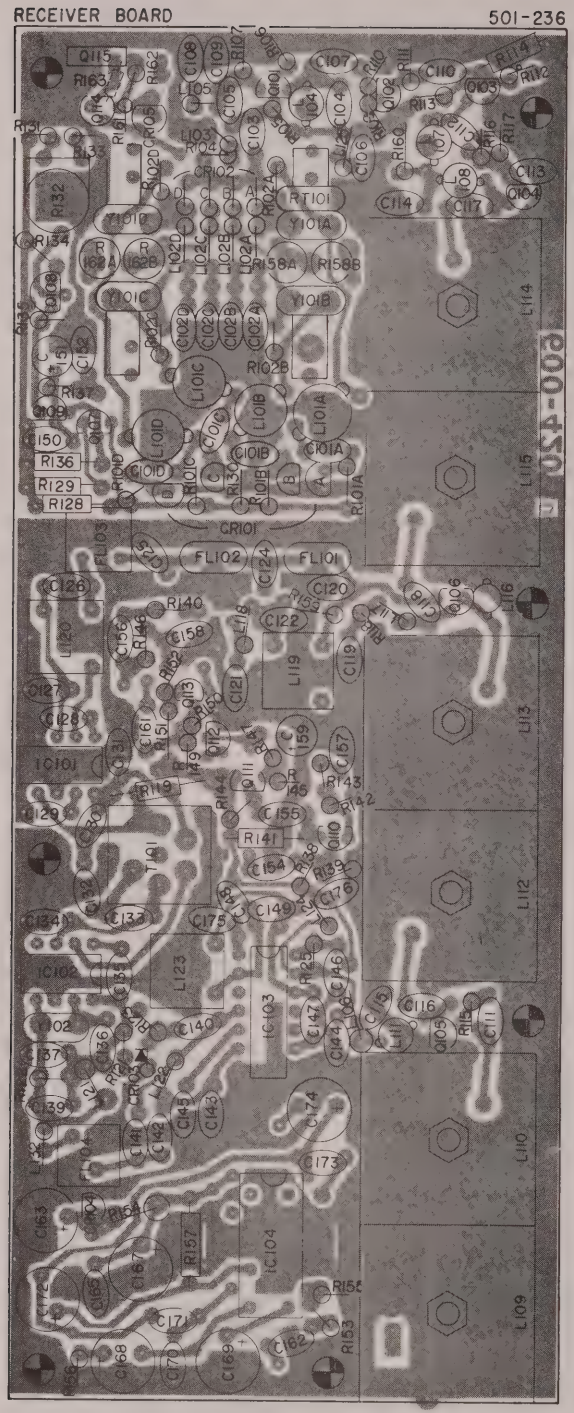
SCHEMATIC



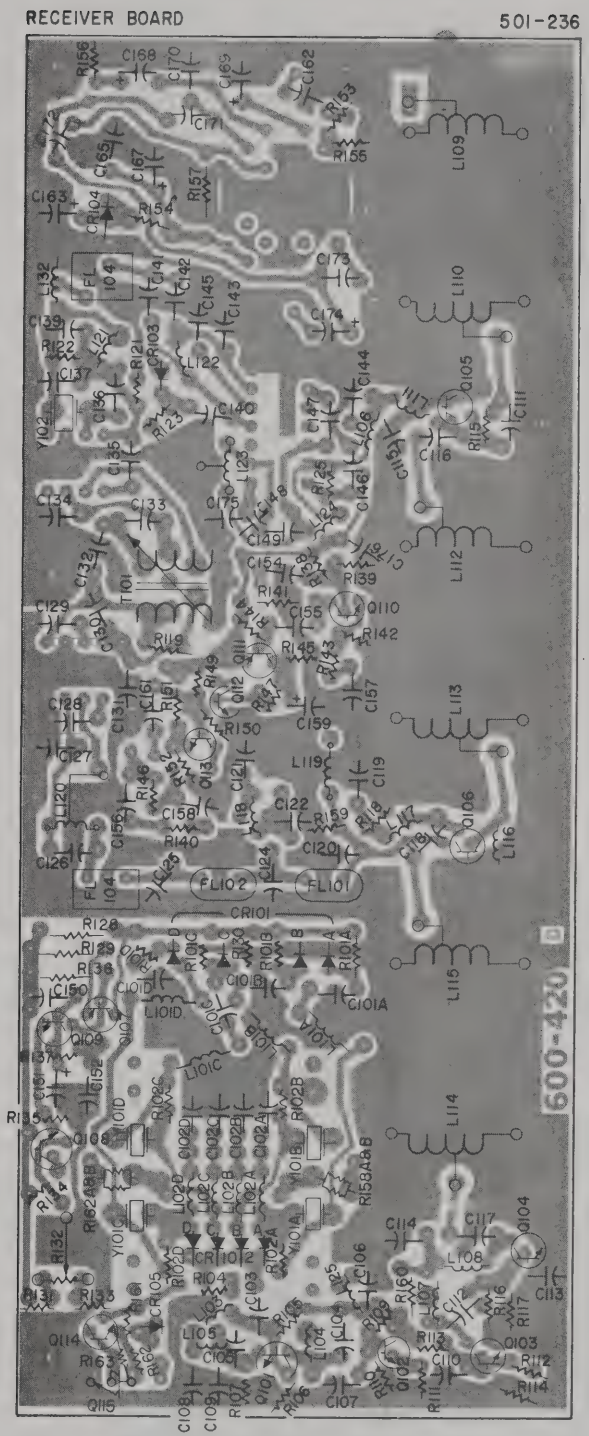
4-1 REGULATOR BOARD TOP VIEW



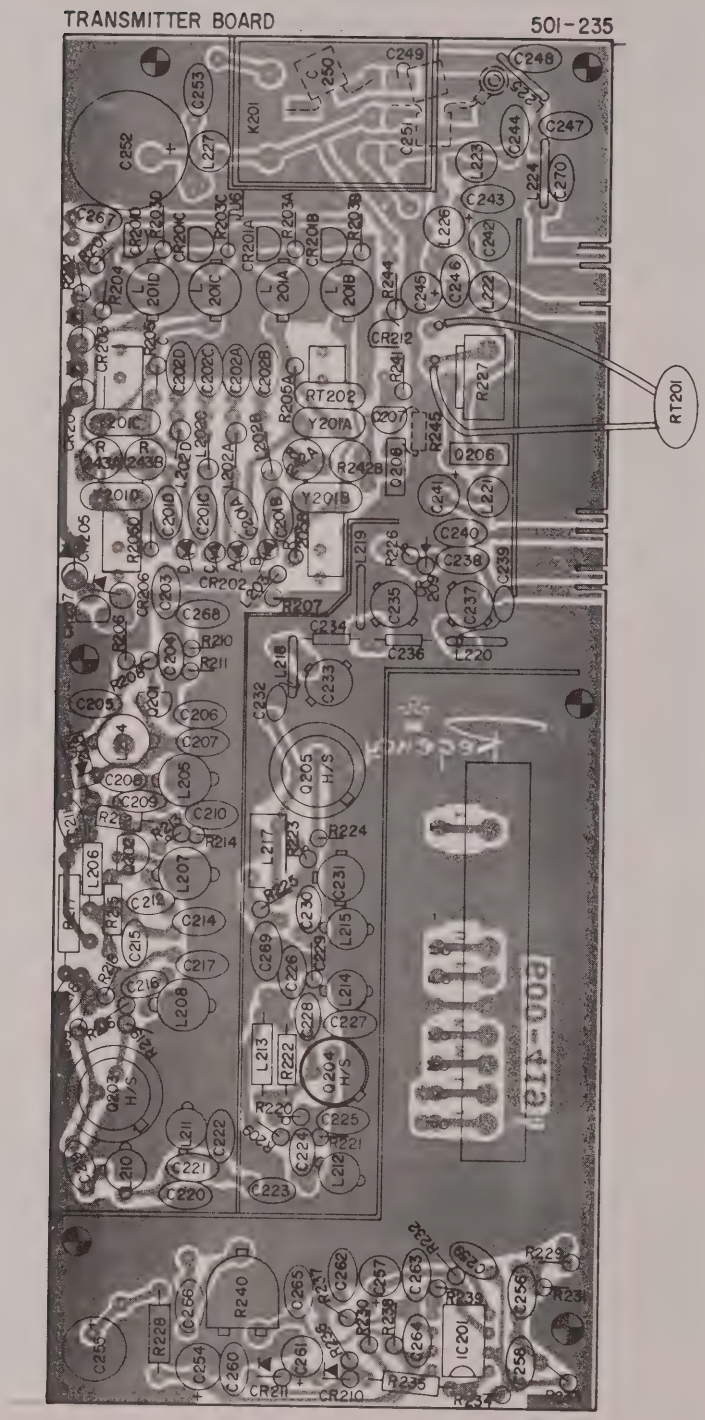
4-2 REGULATOR BOARD BOTTOM VIEW



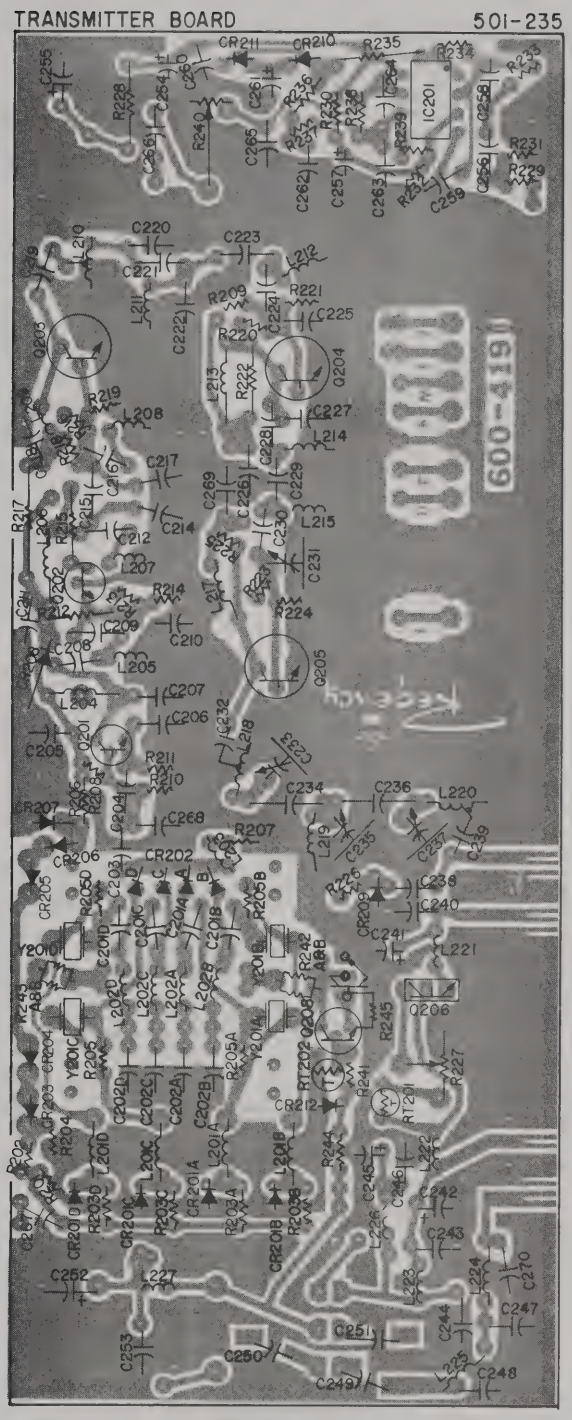
4-3 RECEIVER BOARD TOP VIEW



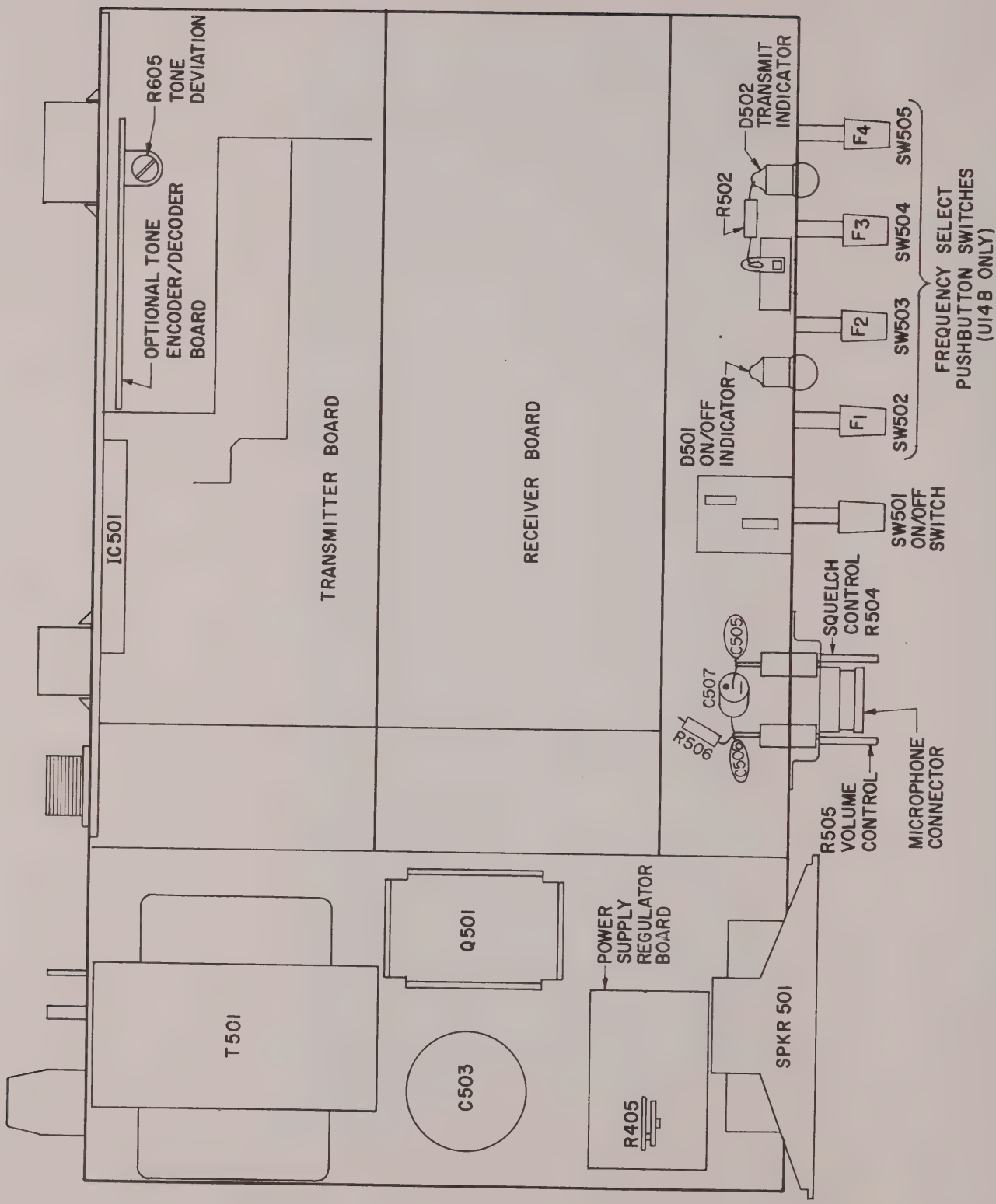
4-4 RECEIVER BOARD BOTTOM VIEW



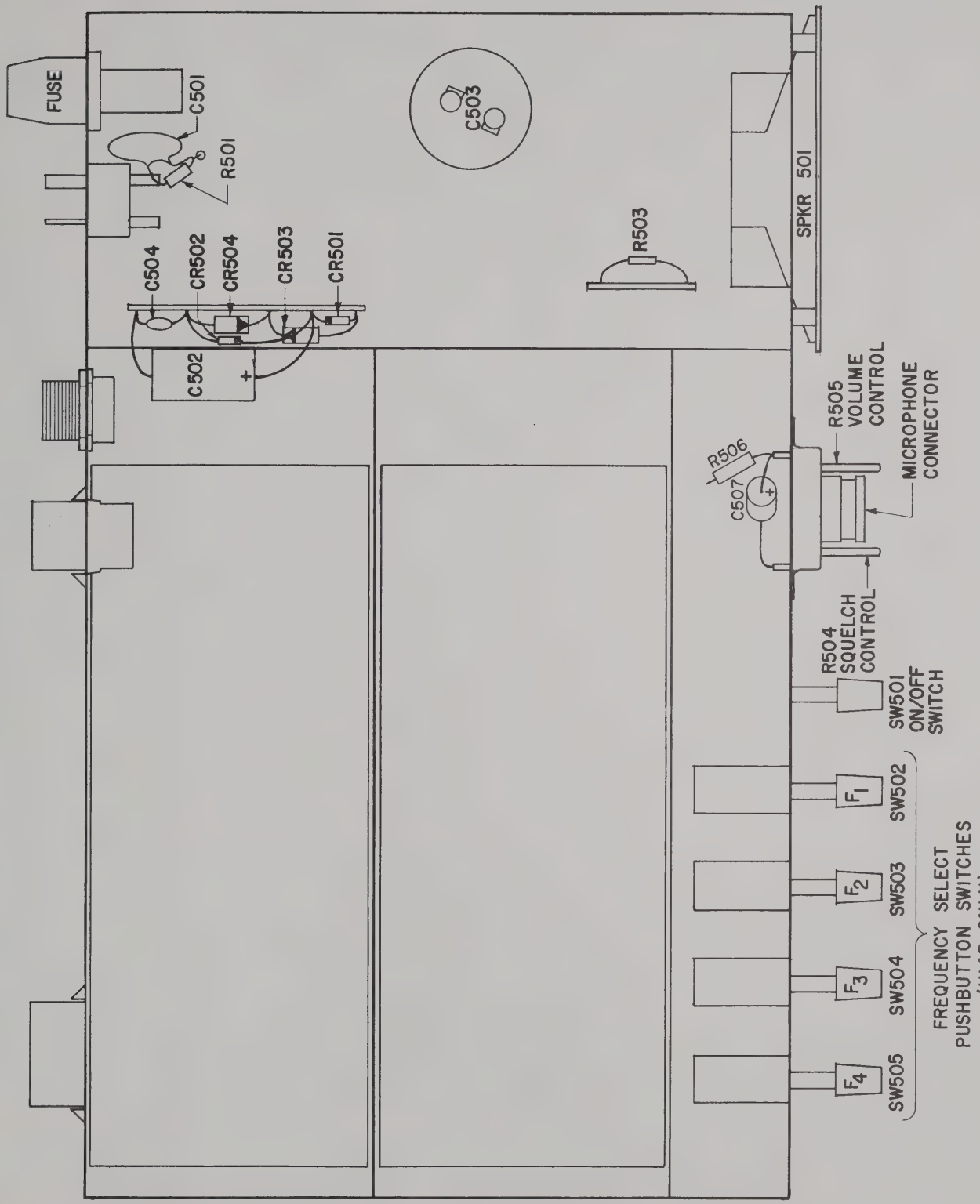
4-5 TRANSMITTER BOARD TOP VIEW



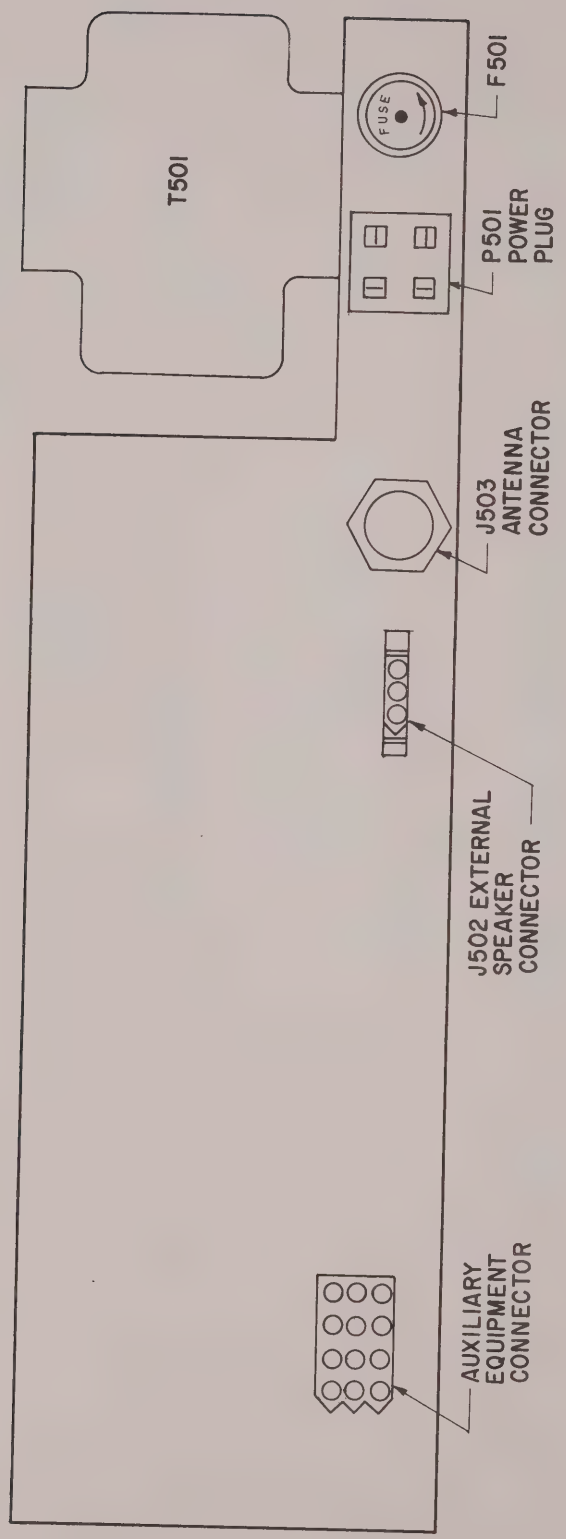
4-6 TRANSMITTER BOARD BOTTOM VIEW



4-7 TOP VIEW
SETUP ADJUSTMENT LOCATIONS



4-8 BOTTOM VIEW
SETUP ADJUSTMENT LOCATIONS



4-9 REAR VIEW
SETUP ADJUSTMENT LOCATIONS

4-10 VOLTAGE DATA

NOTE: All voltages are nominal and are measured with a VTVM, 13.0 VDC supply voltage at the output of the power supply regulator.

VOLTAGE DATA

Receiver Transistors:

	Emitter	Base	Collector
Q101	1.3	2.0	8.6
Q102	4.3	5.1	8.4
Q103	0	0.2	3.5
Q104	0	-0.15	5.2
Q105(FET)	1.9(Source)	0(Gate)	8.5(Drain)
Q106(FET)	.42(Source)	0(Gate)	8.6(Drain)
Q107(PNP)	5	7.5	4.2
Q108	3.5	4.2	7.3
Q109	3.5	4.2	7.7
Q110	1.3	1.9	5.1
Q111	8.7	8.6	0(Unsquelched)
	9.1	8.6	8.4(Tight Squelched)
Q112	0	0	2.3(Unsquelched)
	0	0.7	0(Tight Squelched)
Q113	13.5	2.1	6.1(Unsquelched)
	13.0	0	8.4(Tight Squelched)
Q114	0.4	0.8	13.0 @ 25°C
Q115	0	0.4	13.0 @ 25°C

Receiver Integrated Circuits:

IC No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
IC101	2.2	0.7	0.7	0	4.9	0	2.6	4.9	-	-	-	-	-	-
IC102	2.7	7.2	7.2	2.2	4.8	-	2.8	4.8	-	-	-	-	-	-
IC103	4.3	3.5	-	1.4	1.4	1.4	0	0	0.14	-	-	3.5	8.6	4.8
IC104	13.0	-	-	12.6	0.5	0.5	6.6	0	0	0	-	6.6	-	-

Transmitter Transistors:

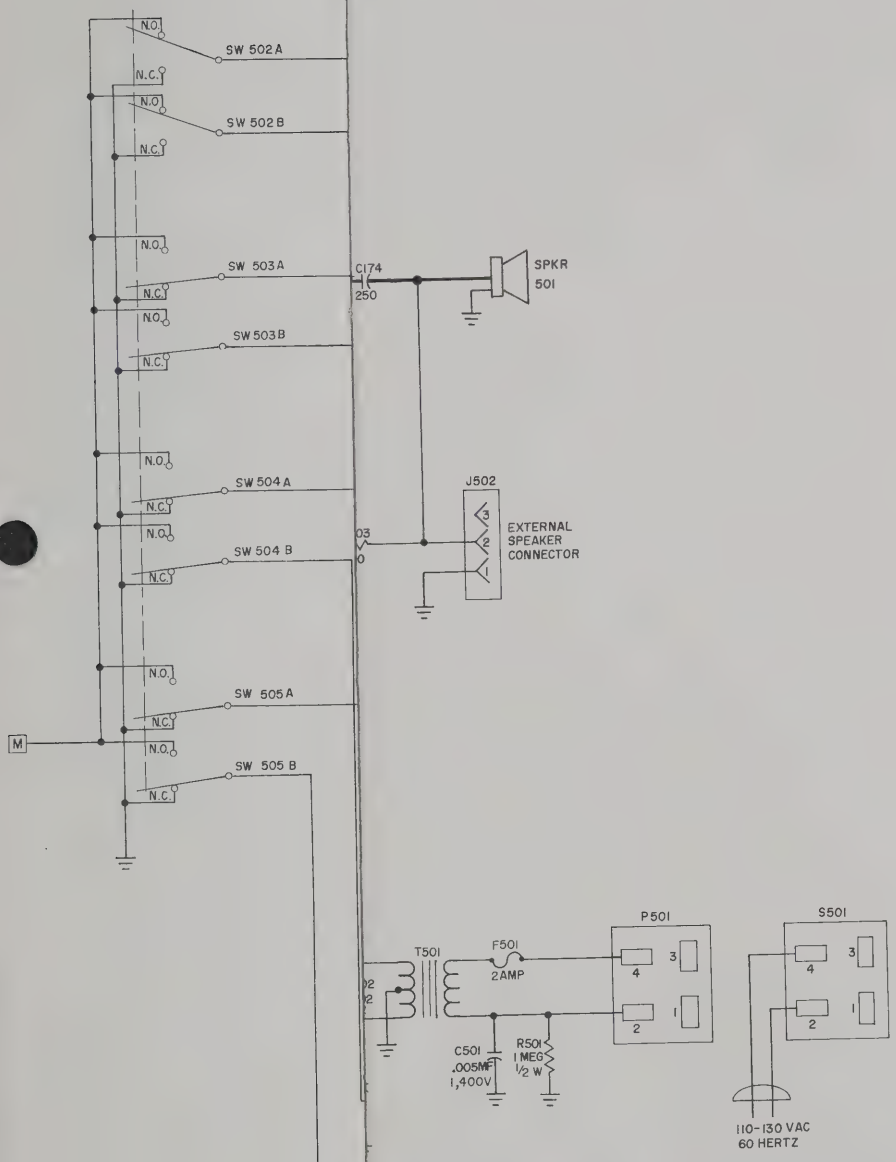
	Emitter	Base	Collector
Q201	3.0	2.0	8.2
Q202	0	0.55	6.0
Q203	0	0.34	10.0
Q204	0	0.05	12.0
Q205	0	-0.62	13.0
Q206 (PNP)	7.0	7.4	11.0
Q207	0.4	0.8	13.0 @ 25°C
Q208	0	0.4	13.0 @ 25°C

Transmitter Integrated Circuits:

IC No.	1	2	3	4	5	6	7	8
IC201	4.0	4.0	4.0	0	4.0	4.0	4.0	8.2
IC202	0	0	13.8	0	6.6	0	-0.1	-

Power Supply Transistors

	Emitter	Base	Collector
Q401	13.8	15.6	23
Q402	6	6.5	15.6
Q501	13	13.8	23



NOTES

1. ALL RESISTOR VALUES NOT SPECIFIED OTHERWISE ARE OHMS
   ALL RESISTORS NOT SPECIFIED OTHERWISE ARE 1/4 W
2. △ NOTED VALUES ARE FACTORY SELECTED, NOMINAL VALUE SHOWN
3. ▭ DENOTES ADJUSTABLE COMPONENTS
4. ⬡ DENOTES CIRCUIT JUNCTION POINTS FOR TONE OPTION
5. HEAVY LINE DENOTES APPARENT SIGNAL FLOW
6. ALL VOLTAGES ARE NOMINAL VALUES AS MEASURED WITH A VTVM, SUPPLY VOLTAGE = 13.8 V DC AT OUTPUT OF REGULATED VOLTAGE SUPPLY.
   a. LETTER FOLLOWING A VOLTAGE INDICATES THE FOLLOWING CONDITIONS:
      U= UNSQUELCHED
      S= SQUELCHED - THRESHOLD
      T= SQUELCHED - TIGHT
   b. VOLTAGES INDICATED IN TRANSMITTER SECTION ARE MEASURED WITH TRANSMITTER IN OPERATION AND CONNECTED TO A PROPER LOAD
7. JUMPER BETWEEN ⬡ AND ⬡ REMOVED WHEN TONE OPTION IS UTILIZED
8. PART DESIGNATION NUMBERS INDICATE LOCATION
   100 SERIES - RECEIVER BOARD
   200 SERIES - TRANSMITTER BOARD
   400 SERIES - POWER SUPPLY REGULATOR BOARD
   500 SERIES - CHASSIS MOUNTED

4-11 SCHEMATIC

u B

Transmitter Transistors:

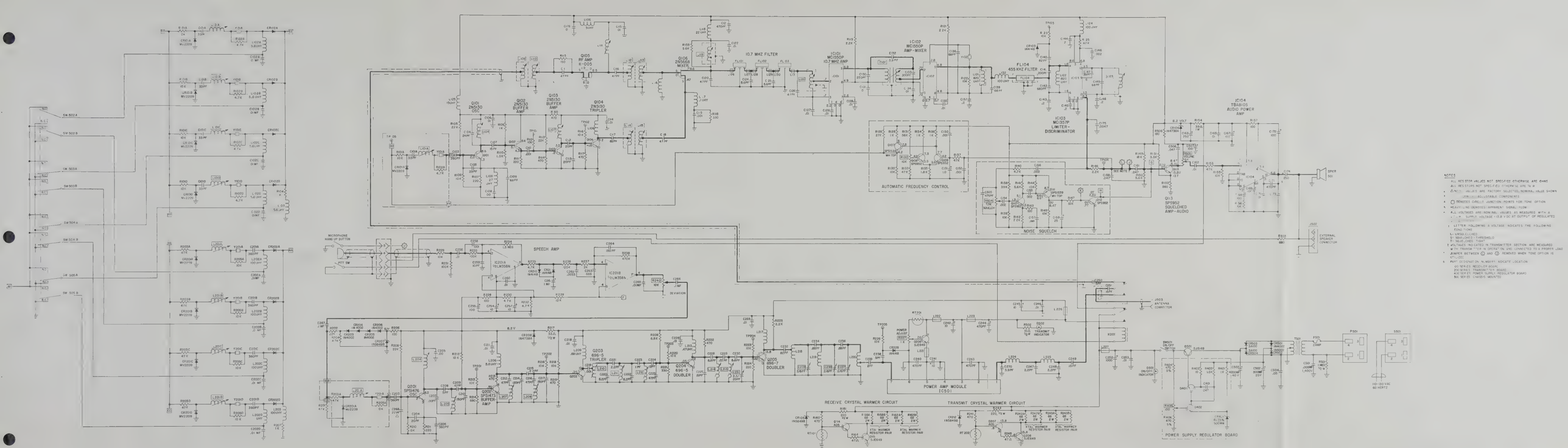
	Emitter	Base	Collector
Q201	3.0	2.0	8.2
Q202	0	0.55	6.0
Q203	0	0.34	10.0
Q204	0	0.05	12.0
Q205	0	-0.62	13.0
Q206(PNP)	7.0	7.4	11.0
Q207	0.4	0.8	13.0 @ 25°C
Q208	0	0.4	13.0 @ 25°C

Transmitter Integrated Circuits:

IC No.	1	2	3	4	5	6	7	8
IC201	4.0	4.0	4.0	0	4.0	4.0	4.0	8.2
IC202	0	0	13.8	0	6.6	0	-0.1	-

Power Supply Transistors

	Emitter	Base	Collector
Q401	13.8	15.6	23
Q402	6	6.5	15.6
Q501	13	13.8	23



NOTES

1. ALL RESISTOR VALUES NOT SPECIFIED OTHERWISE ARE OHMS
2. ALL RESISTORS NOT SPECIFIED OTHERWISE ARE 1/4 W
3. △ INDICATES VALUES ARE FACTORY SELECTED, NOMINAL VALUE SHOWN
4. ○ DENOTES CIRCUIT JUNCTION POINTS FOR TONE OPTION
5. HEAVY LINE DENOTES APPARENT SIGNAL FLOW
6. ALL VOLTAGES ARE NOMINAL VALUES AS MEASURED WITH A ( ) W SUPPLY VOLTAGE (13.8 V DC AT OUTPUT OF REGULATED SUPPLY)
7. LETTER FOLLOWING A VOLTAGE INDICATES THE FOLLOWING CONDITIONS
   R = RX SQUELCHED
   S = SQUELCHED (UNMUTED)
   T = SQUELCHED, TX KEYED
8. VOLTAGES INDICATED IN TRANSMITTER SECTION ARE MEASURED WITH TRANSMITTER IN OPERATION AND CONNECTED TO A PROPER LOAD
9. JUMPER BETWEEN ⓐ AND ⓐ REMOVED WHEN TONE OPTION IS MTU-2EC
10. PART DESIGNATION W/ NUMBERS INDICATE LOCATION
    CO SERIES RECEIVER BOARD
    200 SERIES TRANSMITTER BOARD
    400 SERIES POWER SUPPLY REGULATOR BOARD
    500 SERIES CHASSIS MOUNTED

4-11 SCHEMATIC

SECTION 5
PARTS LIST

NOTE: WHEN ORDERING PARTS, PLEASE INCLUDE THE FOLLOWING INFORMATION:

a. MODEL NUMBER (mcu B)
b. ITEM NUMBER
c. DESCRIPTION
d. PART NUMBER

5-1 REGULATOR BOARD 302-032

ITEM	DESCRIPTION	PART NO.
	RESISTORS	
R401	1K, 10%, ½W	4701-0102-042
R402	1.5K, 10%, ½W	4701-0152-042
R403	10K, 10%, ½W	4701-0103-042
R404	470ohm, 5%, ½W	4701-0471-032
R405	100ohm, Trimmer	4751-0101-005
R406	470ohm, 5%, ½W	4701-0471-032
	CAPACITORS	
C401	.05 mfd, +80-20%, 25v (DISC)	1502-0503-004
	DIODES	
CR401	Zener, 6v, ±5%, 500MW	4801-0000-140
	TRANSISTORS	
Q401	PNP	4801-0000-005
Q402	PNP	4801-0000-010

ITEM	DESCRIPTION	PART NO.

5-2 RECEIVER BOARD

RESISTORS

ITEM	DESCRIPTION	PART NO
R101A	10K,10%,¼W	4701-0103-042
R101B*	10K,10%,¼W	4701-0103-042
R101C*	10K,10%,¼W	4701-0103-042
R101D*	10K,10%,¼W	4701-0103-042
R102A	4.7K,10%,¼W	4701-0472-042
R102B*	4.7K,10%,¼W	4701-0472-042
R102C*	4.7K,10%,¼W	4701-0472-042
R102D*	4.7K,10%,¼W	4701-0472-042
R103		
R104*	1K,10%,¼W	4701-0102-042
R105	22K,10%,¼W	4701-0223-042
R106	10K,10%,¼W	4701-0103-042
R107	220ohm,10%,¼W	4701-0221-042
R108		
R109	1K,10%,¼W	4701-0102-042
R110	1.5K,10%,¼W	4701-0152-042
R111	220ohm,10%,¼W	4701-0221-042
R112	10K,10%,¼W	4701-0103-042
R113	22K,10%,¼W	4701-0223-042
R114	470ohm,10%,¼W	4701-0471-042
R115		
R116	10K,10%,¼W	4701-0103-042
R117	470ohm,10%,¼W	4701-0471-042
R118	330ohm,10%,¼W	4701-0331-042
R119	2.2K,10%,¼W	4701-0222-042
R120		
R121	2.2K,10%,¼W	4701-0222-042
R122	10K,10%,¼W	4701-0103-042
R123	10K,10%,¼W	4701-0103-042
R124		
R125	47K,10%,¼W	4701-0473-042
R126		
R127		
R128	27K,10%,¼W	4701-0273-042
R129	1K,10%,¼W	4701-0102-042
R130	10K,10%,¼W	4701-0103-042
R131	56K,10%,¼W	4701-0563-042
R132	10K,Trimmer	4751-0103-001
R133	47K,10%,¼W	4701-0473-042
R134	1K,10%,¼W	4701-0102-042
R135	1.8K,10%,¼W	4701-0182-042
R136	1K,10%,¼W	4701-0102-042
R137	47K,10%,¼W	4701-0473-042
R138	39K,10%,¼W	4701-0393-042
R139	10K,10%,¼W	4701-0103-042
R140	4.7K,10%,¼W	4701-0472-042
R141	5.6K,10%,¼W	4701-0562-042
R142	2.2K,10%,¼W	4701-0222-042
R143	100ohm,10%,¼W	4701-0101-042
R144	10K,10%,¼W	4701-0103-042
R145	10K,10%,¼W	4701-0103-042
R146	2.2K,10%,¼W	4701-0222-042
R147	10K,10%,¼W	4701-0103-042
R148		
R149	18K,10%,¼W	4701-0183-042
R150	5.6K,10%,¼W	4701-0562-042
R151	3.3K,10%,¼W	4701-0332-042
R152	560ohm,10%,¼W	4701-0561-042
R153	47K,10%,¼W	4701-0473-042
R154	39ohm,10%,1W	4701-0390-045
R155	10K,10%,¼W	4701-0103-042
R156	56ohm,10%,¼W	4701-0561-042
R157	100ohm,10%,¼W	4701-0101-042
R158A	68ohm,10%,2W(wire wound)	4710-0680-041
R158B	68ohm,10%,2W(wire wound)	4710-0680-041
R159	5.6K 10%,¼W	4701-0562-042
R160	470ohm,10%,¼W	4701-0471-042
R161	220ohm,10%,¼W	4701-0221-044
R162A*	68ohm,10%,2W(wire wound)	4710-0680-041
R162B*	68ohm,10%,2W(wire wound)	4710-0680-041
R163	47ohm,10%,¼W	4701-0470-042

CAPACITORS

ITEM	DESCRIPTION	PART NO
C101A	33PF,10%,NPO,50V(DISC)	1500-0330-650
C101B*	33PF,10%,NPO,50V(DISC)	1500-0330-650
C101C*	33PF,10%,NPO,50V(DISC)	1500-0330-650
C101D*	33PF,10%,NPO,50V(DISC)	1500-0330-640
C102A*	.01 mfd,+80-20%,12V(DISC)	1502-0103-006
C102B*	.01 mfd,+80-20%,12V(DISC)	1502-0103-006
C102C*	.01 mfd,+80-20%,12V(DISC)	1502-0103-006
C102D*	.01 mfd,+80-20%,12V(DISC)	1502-0103-006
C103	360 PF 5%,50V(MICA)	1506-0361-550
C105	39 PF,10%,NPO,50V(DISC)	1500-0390-650
C106	.01 mfd,+80-20%,12V(DISC)	1502-0103-006
C107	15PF,10%,NPO,50V(DISC)	1500-0150-650
C108	.001 mfd,20%,50V(DISC)	1523-0102-002
C109	68PF,5%,NPO,50V(DISC)	1524-0680-002
C110	.001 mfd,20%,50V(DISC)	1523-0102-002
C111	47PF,5%,NPO,50V(DISC)	1524-0470-002
C112	20PF,10%,NPO,50V(DISC)	1500-0200-650
C113	20PF,10%,NPO,50V(DISC)	1500-0200-650
C114	.01 mfd,+80-20%,12V(DISC)	1502-0103-006
C115	.01 mfd,+80-20%,12V(DISC)	1502-0103-006
C116	47PF,5%,NPO,50V(DISC)	1524-0470-002
C117	82PF,5%,NPO,50V(DISC)	1524-0820-002
C118	47PF,5%,NPO,50V(DISC)	1524-0470-002
C119	.001 mfd,20%,50V(DISC)	1523-0102-002
C120	47PF,5%,NPO,50V(DISC)	1524-0470-002
C121	470PF,20%,50V(DISC)	1523-0471-002
C122	.01 mfd,+80-20%,12V(DISC)	1502-0103-006
C124	5.6PF,10%,NPO,500V(DISC)	1500-0569-905
C125	5.6PF,10%,NPO,500V(DISC)	1500-0569-905
C126	47PF,5%,NPO,50V(DISC)	1524-0470-002
C127	.01 mfd,+80-20%,12V(DISC)	1502-0103-006
C128	.01 mfd,+80-20%,12V(DISC)	1502-0103-006
C129	.01 mfd,+80-20%,12V(DISC)	1502-0103-006
C130	220PF,5%,50V(MICA)	1506-0221-550
C131	.01 mfd,+80-20%,12V(DISC)	1502-0103-006
C132	3.9PF,10%,NPO,500V(DISC)	1500-0399-905
C133	300PF,5%,50V(MICA)	1506-0301-550
C134	.01 mfd,+80-20%,12V(DISC)	1502-0103-006
C135	.01 mfd,+80-20%,12V(DISC)	1502-0103-006
C136	68PF,5%,NPO,50V(DISC)	1524-0680-002
C137	.2 mfd,+80-20%,12V(DISC)	1502-0204-006
C139	68PF,5%,50V(MICA)	1506-0680-550
C140	82PF,5%,NPO,50V(DISC)	1524-0820-002
C141	200PF,5%,50V(MICA)	1506-0201-550
C142	680PF,5%,50V(MICA)	1506-0681-550
C143	.2 mfd,+80-20%,12V(DISC)	1502-0204-006
C144	.2 mfd,+80-20%,12V(DISC)	1502-0204-006
C145	.2 mfd,+80-20%,12V(DISC)	1502-0204-006
C146	.002 mfd,20%,50V(DISC)	1523-0202-002
C147	39PF,10%,NPO,50V(DISC)	1500-0390-650
C148	.2 mfd,+80-20%,12V(DISC)	1502-0204-006
C149	68PF,5%,NPO,50V(DISC)	1524-0680-002
C150	.001 mfd,20%,50V(DISC)	1523-0102-002
C151	1 mfd,50V,85°C (Electrolytic)	1513-0010-004
C152	.001 mfd,20%,50V(DISC)	1523-0102-002
C153	.002 mfd,20%,50V(DISC)	1523-0202-002
C154	.002 mfd,20%,50V(DISC)	1523-0202-002
C155	.002 mfd,20%,50V(DISC)	1523-0202-002
C156	.002 mfd,20%,50V(DISC)	1523-0202-002
C157	.1 mfd,20%,12V(DISC)	1502-0104-005
C158	.047 mfd,10%,100V(Mylar Film)	1508-0473-610
C159	25 mfd,10V,85°C (Electrolytic)	1513-0250-001
C161	.047 mfd,10%,100V(Mylar Film)	1508-0473-610
C162	.01 mfd,+80-20%,12V(DISC)	1502-0103-006
C163	250 mfd,16V,85°C (Electrolytic)	1513-0251-002
C165	.01 mfd,+80-20%,12V(DISC)	1502-0103-006
C167	100 mfd,16V,85°C (Electrolytic)	1513-0101-001
C168	100 mfd,16V,85°C (Electrolytic)	1513-0101-001
C169	100 mfd,16V,85°C (Electrolytic)	1513-0101-001
C170	.01 mfd,+80-20%,12V(DISC)	1502-0103-006
C171	470PF,20%,50V(DISC)	1523-0471-002
C172	100 mfd,16V,85°C (Electrolytic)	1513-0101-001
C173	.01 mfd,+80-20%,12V(DISC)	1502-0103-006
C174	250 mfd,16V,85°C (Electrolytic)	1513-0251-002
C175	.0047 mfd,10%,100V(Mylar Film)	1508-0472-610
C176	.01 mfd,+80-20%,12V(DISC)	1502-0103-006

5-2 RECEIVER BOARD

ITEM	DESCRIPTION	PART NO.
	COILS	
L101A	Frequency Adjust	1800-3191-406
L101B*	Frequency Adjust	1800-3191-406
L101C*	Frequency Adjust	1800-3191-406
L101D*	Frequency Adjust	1800-3191-406
L102A*	Choke,RF,5.6 uhy	1802-0569-008
L102B*	Choke,RF,5.6 uhy	1802-0569-008
L102C*	Choke,RF,5.6 uhy	1802-0569-008
L102D*	Choke,RF,5.6 uhy	1802-0569-008
L103*	Choke,RF,5.6 uhy	1802-0569-008
L104	Oscillator Adjust	1800-5100-521
L105	Choke,RF,.27 uhy	1802-0278-008
L106	Choke,RF,15 uhy	1802-0150-004
L107	Buffer Adjust	1800-5100-511
L108	Choke,RF	1800-5100-523
L111	Choke,RF	1800-5100-522
L116	Choke,RF	1800-5100-523
L117	Choke,RF,.1 uhy	1802-0108-008
L118	Choke,RF,22 uhy	1802-0220-008
L119	Crystal Filter Tune	1800-3248-001
L120	Crystal Filter Tune	1800-3248-001
L121	Choke,RF,820 uhy	1802-0000-002
L122	Choke,RF,820 uhy	1803-3182-700
L123	Discriminator Adjust	1800-3218-800
L124	Choke,RF,100 uhy	1802-0101-008
L125	Choke,RF,15 uhy	1802-0150-004
L126	Bead,Choke	2502-0000-001
L127	Bead,Choke	2502-0000-001
L128	Bead,Choke	2502-0000-001
L129	Bead,Choke	2502-0000-001
L130	Bead,Choke	2502-0000-001
L131	Bead,Choke	2502-0000-001
L132	Choke,RF,100 uhy	1802-0101-008
T101	Coil	1800-3168-300
	DIODES	
CR101A	Varicap,MV2209	4809-0000-001
CR101B*	Varicap,MV2209	4809-0000-001
CR101C*	Varicap,MV2209	4809-0000-001
CR101D*	Varicap,MV2209	4809-0000-001
CR102A*	Germ,102-339	4807-1233-900
CR102B*	Germ,102-339	4807-1233-900
CR102C*	Germ,102-339	4807-1233-900
CR102D*	Germ,102-339	4807-1233-900
CR103	Sil,102-412,1N4148	4805-1241-200
CR104	Zener,8.2V,1N4738A	4808-0000-009
CR105	Zener,6v,5%,MZ92-6.0B	4808-0000-012
	TRANSISTORS	
Q101	NPN	4801-0000-095
Q102	NPN	4801-0000-095
Q103	NPN	4801-0000-095
Q104	NPN	4801-0000-095
Q105	FET	4811-0000-005
Q106	FET	4811-0000-030
Q107	PNP(Wht Top)	4801-0000-060
Q108	NPN	4801-0000-010
Q109	NPN	4801-0000-010
Q110	NPN	4801-0000-010
Q111	PNP(Wht Top)	4801-0000-060
Q112	NPN	4801-0000-010
Q113	NPN	4801-0000-010
Q114	NPN	4801-0000-005
Q115	NPN	4802-0000-002
	THERMISTORS	
RT101	Thermistor	5300-0000-001

ITEM	DESCRIPTION	PART NO.
	INTEGRATED CIRCUITS	
IC101	10.7 MHz Amp	3130-3167-901
IC102	Amp-Mixer	3130-3167-901
IC103	Limiter-Discriminator	3130-3157-603
IC104	Audio Amp	3130-3248-801
	FILTERS	
FL101	Filter,Xtal 2P 10.7 MHz	2705-3232-200
FL102	Filter,Xtal 2P 10.7 MHz	2705-1306-600
FL103	Filter,Xtal 2P 10.7 MHz	2705-3232-200
FL104	Filter,Ceramic CFU455D	2700-3209-500
	CRYSTALS	
Y102	10.245 MHz(Standard)	2301-3151-601

*Parts applicable to U14B only

5-3 TRANSMITTER BOARD

ITEM	DESCRIPTION	PART NO.
	RESISTORS	
R201	47K,10%,¼W	4701-0473-042
R202	22K,10%,¼W	4701-0223-042
R203A	47K,10%,¼W	4701-0473-042
R203B*	47K,10%,¼W	4701-0473-042
R203C*	47K,10%,¼W	4701-0473-042
R203D*	47K,10%,¼W	4701-0473-042
R204	4.7K,10%,¼W	4701-0472-042
R205A	10K,10%,¼W	4701-0103-042
R205B*	10K,10%,¼W	4701-0103-042
R205C*	10K,10%,¼W	4701-0103-042
R205D*	10K,10%,¼W	4701-0103-042
R206	100ohm,10%,¼W	4701-0101-042
R207*	1K,10%,¼W	4701-0102-042
R208	22K,10%,¼W	4701-0223-042
R209	6.8K,10%,¼W	4701-0682-042
R210	10K,10%,¼W	4701-0103-042
R211	220ohm,10%,¼W	4701-0221-042
R212	10K,10%,¼W	4701-0103-042
R213	10K,10%,¼W	4701-0103-042
R214	680ohm,10%,¼W	4701-0681-042
R215	470ohm,10%,¼W	4701-0471-042
R216	10K,10%,¼W	4701-0103-042
R217	33ohm,10%,½W	4701-0330-044
R218	10K,10%,¼W	4701-0103-042
R219	470ohm,10%,¼W	4701-0471-042
R220	10K,10%,¼W	4701-0103-042
R221	330ohm,10%,¼W	4701-0331-042
R222	470ohm,10%,¼W	4701-0471-042
R223	10K,10%,¼W	4701-0103-042
R224	220ohm,10%,¼W	4701-0221-042
R225	2.2K,10%,¼W	4701-0222-042
R226	10K,10%,¼W	4701-0103-042
R227	1K,Trimmer	4751-0102-005
R228	100ohm,10%,¼W	4701-0101-042
R229	10K,10%,¼W	4701-0103-042
R230	4.7K,10%,¼W	4701-0472-042
R231	100K,10%,¼W	4701-0104-042
R232	4.7K,10%,¼W	4701-0472-042
R233	100K,10%,¼W	4701-0104-042
R234	1.5meg,10%,¼W	4701-0155-042
R235	4.7K,10%,¼W	4701-0472-042
R236	120K,10%,¼W	4701-0124-042
R237	12K,10%,¼W	4701-0123-042
R238	470K,10%,¼W	4701-0474-042
R239	12K,10%,¼W	4701-0123-042
R240	10K,Trimmer	4751-0103-001
R241	470ohm,10%,¼W	4701-0471-042
R242A	68ohm,10%,2W(wire wound)	4710-0680-041
R242B	68ohm,10%,2W(wire wound)	4710-0680-041
R243A*	68ohm,10%,2W(wire wound)	4710-0680-041
R243B*	68ohm,10%,2W(wire wound)	4710-0680-041
R244	47ohm,10%,½W	4701-0470-044
R245	47ohm,10%,¼W	4701-0470-042
	CAPACITORS	
C201A*	360PF,5%,50V(MICA)	1506-0361-550
C201B*	360PF,5%,50V(MICA)	1506-0361-550
C201C*	360PF,5%,50V(MICA)	1506-0361-550
C201D*	360PF,5%,50V(MICA)	1506-0361-550
C202A*	.01 mfd,+80-20%,12V(DISC)	1502-0103-006
C202B*	.01 mfd,+80-20%,12V(DISC)	1502-0103-006
C202C*	.01 mfd,+80-20%,12V(DISC)	1502-0103-006
C202D*	.01 mfd,+80-20%,12V(DISC)	1502-0103-006
C203	360PF,5%,50V(MICA)	1506-0361-550
C204	20PF,10%,NPO,50V(DISC)	1500-0200-650
C205	.001 mfd,20%,50V(DISC)	1523-0102-002
C206	360PF,5%,50V(MICA)	1506-0361-550
C207		
C208	5PF,10%,NPO,500V(DISC)	1500-0050-905
C209		
C210	150PF,5%,50V(MICA)	1506-0151-550
C211	.01 mfd,+80-20% 12V(DISC)	1502-0103-006
C212	47PF,5%,NPO,50V(DISC)	1524-0470-002

ITEM	DESCRIPTION	PART NO.
C214	120PF,5%,50V(MICA)	1506-0121-550
C215	2.2PF,±.25PF,NPO(DISC)	1500-0229-205
C216	47PF,5%,NPO,50V(DISC)	1524-0470-002
C217	150PF,5%,50V(MICA)	1506-0151-550
C218	.01 mfd,+80-20%,25V(DISC)	1502-0103-004
C219	.001 mfd,20%,50V(DISC)	1523-0102-002
C220	8.2PF,10%,NPO,500V(DISC)	1500-0829-905
C221	2.2PF,±.25PF,NPO(DISC)	1500-0229-205
C222	8.2PF,10%,NPO,500V(DISC)	1500-0829-905
C223	1PF,10%(Composition)	1510-0010-900
C224	12PF,10%,NPO,500V(DISC)	1500-0150-605
C225	47PF,5%,NPO,50V(DISC)	1524-0470-002
C226	.01 mfd,+80-20%,25V(DISC)	1502-0103-004
C227	15PF,10%,NPO,50V(DISC)	1500-0150-650
C228	6.8PF,10%,NPO,500V(DISC)	1500-0689-905
C229	0.22PF,10%(Composition)	1510-0228-900
C230		
C231	2.5-20PF,Trimmer	1517-0000-019
C232	82PF,5%,NPO,50V(DISC)	1501-0820-008
C233	2-6PF,Trimmer	1517-0000-018
C234	0.68PF,10%(Composition)	1510-0688-900
C235	2-6PF,Trimmer	1517-0000-018
C236	0.68PF,10%(Composition)	1510-0688-900
C237	2-6PF,Trimmer	1517-0000-018
C238	5PF,10%,NPO,500V(DISC)	1500-0050-905
C239	2PF,NPO(DISC)	1501-0020-001
C240	470PF,20%,50V(DISC)	1523-0471-002
C241	10 mfd,25V,85°C (Electrolytic)	1513-0100-003
C242	10 mfd,25V,85°C (Electrolytic)	1513-0100-003
C243	470PF,20%,50V(DISC)	1523-0471-002
C244	470PF,20%,50V(DISC)	1523-0471-002
C245	10 mfd,25V,85°C (Electrolytic)	1513-0100-003
C246	.01 mfd,+80-20%,25V(DISC)	1502-0103-004
C247	2.2PF,±.25PF,NPO(DISC)	1500-0229-205
C248		
C249	15PF,10%,NPO,50V(DISC)	1500-0150-650
C250	15PF,10%,NPO,50V(DISC)	1500-0150-650
C251	15PF,10%,NPO,50V(DISC)	1500-0150-650
C252	1000 mfd,16V,85°C (Electrolytic)	1513-0102-002
C253	.01 mfd,+80-20%,25V(DISC)	1502-0103-004
C254	10 mfd,25V,85°C (Electrolytic)	1513-0100-003
C255	100 mfd,16V,85°C (Electrolytic)	1513-0101-002
C256	.01 mfd,+80-20%,12V(DISC)	1502-0103-006
C257	10 mfd,25V,85°C (Electrolytic)	1513-0100-003
C258	.001 mfd,20%,50V(DISC)	1523-0102-002
C259	10PF,10%,NPO,500V(DISC)	1500-0100-605
C260	.01 mfd,+80-20%,12V(DISC)	1502-0103-006
C261	1 mfd,50V,85°C (Electrolytic)	1513-0010-004
C262	.0033 mfd,10%,100V(Mylar Film)	1508-0332-610
C263	.003 mfd,10%,100V(Mylar Film)	1508-0333-610
C264	150PF,20%,50V(DISC)	1523-0151-002
C265	.01 mfd,+80-20%,12V(DISC)	1502-0103-006
C266	.1 mfd,20%,12V(DISC)	1502-0104-005
C267	.1 mfd,20%,12V(DISC)	1502-0104-005
C268	22PF,10%,NPO,500V(DISC)	1500-0220-605
C269	.01 mfd,+80-20%,25V(DISC)	1502-0103-004
C270	3.9PF,±.25PF,NPO,500V(DISC)	1500-0399-205

5-3 TRANSMITTER BOARD

ITEM	DESCRIPTION	PART NO.
	COILS	
L201A	Frequency Adjust	1800-3247-201
L201B*	Frequency Adjust	1800-3247-201
L201C*	Frequency Adjust	1800-3247-201
L201D*	Frequency Adjust	1800-3247-201
L202A*	Choke,RF,100 uhy	1802-0101-008
L202B*	Choke,RF,100 uhy	1802-0101-008
L202C*	Choke,RF,100 uhy	1802-0101-008
L202D*	Choke,RF,100 uhy	1802-0101-008
L203*	Choke,RF,100 uhy	1802-0101-008
L204	Oscillator,output	1800-3191-404
L205	Buffer,input	1800-3191-405
L206	Choke,RF,5.6 uhy	1802-0569-008
L207	Buffer,input	1800-3191-405
L208	Buffer,input	1800-3191-405
L209	Choke,RF,.68 uhy	1802-0688-003
L210	Tripler,output	1800-5100-524
L211	Tripler,output	1800-5100-520
L212	Doubler,input	1800-5100-520
L213	Choke,RF,.47 uhy	1802-0478-008
L214	Doubler,output	1800-5100-511
L215	Doubler,output	1800-5100-511
L216		
L217	RF,inductor	1802-5125-904
L218	RF,inductor	1801-3247-401
L219	RF,inductor	1801-3247-401
L220	RF,inductor	1801-3247-401
L221	RF,Bead Assy.	2502-3254-101
L222	RF,Bead Assy.	2502-3254-101
L223	RF,Bead Assy.	2502-3254-101
L224	RF,inductor	1801-3247-401
L225	RF,inductor	1801-3247-401
L226	RF,Bead Assy.	2502-3254-101
L227	RF,Bead Assy.	2502-3254-101
	DIODES	
CR201A	Varicap,MV2209	4809-0000-001
CR201B*	Varicap,MV2209	4809-0000-001
CR201C*	Varicap,MV2209	4809-0000-001
CR201D*	Varicap,MV2209	4809-0000-001
CR202A*	Germ,1O2-339	4807-1233-900
CR202B*	Germ,1O2-339	4807-1233-900
CR202C*	Germ,1O2-339	4807-1233-900
CR202D*	Germ,1O2-339	4807-1233-900
CR203	Sil Rect,1N4002	4806-0000-004
CR204	Sil Rect,1N4002	4806-0000-004
CR205	Sil Rect,1N4002	4806-0000-004
CR206	Sil Rect,1N4002	4806-0000-004
CR207	Zener,6V,5%,MZ92-6.0B	4808-0000-012
CR208	Zener,8.2V,1N4738A	4808-0000-009
CR209	Sil,1N4148,1O2-412	4805-1241-200
CR210	Sil,1N4148,1O2-412	4805-1241-200
CR211	Sil,1N4148,1O2-412	4805-1241-200
CR212	Zener,6V,5%,MZ92-6.0B	4804-0000-012
	TRANSISTORS	
Q201	Silicon,NPN(Blu Top)	4801-0000-003
Q202	Silicon,NPN(Red Top)	4801-0000-035
Q203	NPN,RF power	4804-3169-605
Q204		
Q205	NPN,RF power	4804-3169-607
Q206	NPN	4802-0000-002
Q207	NPN	4801-0000-005
Q208	NPN	4802-0000-002
	THERMISTORS	
RT201	Thermistor	5300-0000-004
RT202	Thermistor	5300-0000-001

ITEM	DESCRIPTION	PART NO.
	INTEGRATED CIRCUITS	
IC201	Speech Amp	3130-3167-909
	ELECTRICAL COMPONENTS	
K201	Relay	4500-0000-004

*Parts applicable to U14B only

5-4 CHASSIS ASS'Y

ITEM	DESCRIPTION	PART NO.
	ELECTRICAL COMPONENTS	
R501	1meg,10%,½W	4701-0105-044
R502	10ohm,10%,½W	4701-0100-044
R503	680ohm,10%,½W	4701-0681-044
R504	7.5K,Squelch Control	4752-0752-001
R505	5K,Volume Control	4752-0502-001
R506	180ohm,10%,½W	4701-0181-042
C501	.005 mfd,1.4KV(DISC)	1501-0502-002
C502	500 mfd,25V,85°C(Electrolytic)	1511-0501-003
C503	4200 mfd(Electrolytic)	1516-0422-001
C504	.05 mfd,25V(DISC)	1502-0503-004
C505	470PF,20%,50V(DISC)	1501-0471-007
C506	.047 mfd,10%,100V(Mylar Film)	1508-0473-610
C507	100 mfd,25V,85°C(Electrolytic)	1511-0101-003
CR501	Diode,Silicon,Rectifier	4806-0000-004
CR502	Diode,Silicon,Rectifier	4806-0000-004
CR503	Diode,Silicon,Rectifier	4806-0000-005
CR504	Diode,Silicon,Rectifier	4806-0000-005
SPK501	Speaker Assy	1301-0000-003
SW501	Power Switch	5112-5087-406
SW502*	F1,Frequency Select Switch	5112-6035-823
SW503*	F2,Frequency Select Switch	5112-6035-823
SW504*	F3,Frequency Select Switch	5112-6035-823
SW505*	F4,Frequency Select Switch	5112-6035-823
	Terminal Lug Strip	2103-3008-004
	Terminal Lug Strip	2103-5000-120
	Terminal Lug Strip	2103-3008-012
	Crystal,Transmit(Specify Freq. or Channel No.)	2328-0000-000
	Crystal,Receive(Specify Freq. or Channel No.)	2329-0000-000
J502	Remote Speaker Connector Housing, Male	2109-5120-403
J503	Antenna Connector	2105-0000-020
	Auxiliary Connector Housing,Male	2109-5120-408
	Connector,Microphone	2105-0000-023
	Microphone Assy	7011-4000-300
	A.C. Power Cord Assy	7011-1037-700
Q501	Transistor,SJ5149	4803-0000-005
T501	Transformer,Power	5604-5097-100
	Socket,Transistor	2108-0000-002
IC501	Module RF Amp UHF	3132-5112-501
F501	Fuse,2 Amp	5106-0000-004
D501	Lamp,Clear	3901-0000-002
D502	Lamp,Clear	3901-0000-002
	Plug,Power	2104-0000-004

ITEM	DESCRIPTION	PART NO.

MECHANICAL COMPONENTS

	Heat Sink	5400-3248-300
	Heat Sink	5400-3401-400
	Heat Sink	5400-1260-900
	Heat Sink	5400-0000-001
	Heat Sink	5400-1285-601
	Insulating Bushing	2501-0000-001
	Insulating Mica Washer	3103-0000-001
	Clamp,Capacitor	2830-0000-002
	A.C. Shield	2508-3401-700
	Knob,Volume and Squelch	2402-2167-001
	Fuseholder W/Nut and Washer	2100-0000-003
	Wrap	1408-6401-400
	Back Panel	1405-5401-900
	Manual,Owner's Instruction	7001-4005-800
	Lens,Red	3900-0000-002
	Lens,Green	3900-0000-003

*Parts Applicable for U14B Only

SECTION 6

TONE SQUELCH OPTION

SECTION 6 TONE SQUELCH (CTCSS) OPTION

6-1 GENERAL DESCRIPTION

The Model MA-90 Tone Squelch system is supplied as a factory installed, or field installed option to MICRO-COM U11B and MICRO-COM U14B model transceivers. This option equips the radio for operation on systems using Continuous Tone Controlled Squelch Systems (CTCSS).

The circuit elements of the MA-90 tone squelch system are mounted on a plug-in circuit board module, which fits into a shielded compartment and socket located in the transmitter section of the transceiver.

Whether supplied with, or without, the Tone Squelch option, all MICRO-COM U11B and U14B transceivers are equipped with the shielded compartment and connector socket to accept the Tone Squelch module. When the transceivers are supplied without the tone squelch option, a jumper wire is installed on the transmitter circuit board, near the tone option socket to permit operation of the receiver without the tone module.

A block diagram of the tone system is shown in Figure 6-4, and a full schematic is shown in Figure 6-7.

6-2 CIRCUIT DESCRIPTION (Tone Receiving Condition)

Audio from the receiver discriminator is fed into the tone squelch board at terminal L, and passes through the High Pass Filter IC601, and back to the receiver's audio amplifier circuits at terminal J. The high pass filter removes the CTCSS tones, which are below the normally utilized speech frequencies, so they will not be heard on the receiver loudspeaker.

Audio from the receiver discriminator (at L) is also fed into IC602, which contains a low pass filter, and a limiter amplifier. The low pass filter removes most of the speech and higher frequency noise components from the signal, leaving essentially only the CTCSS tone frequencies and low frequency noise components. This filtered signal is then passed to the combination of IC603 and IC604, which acts as a high Q band pass filter, tuned sharply to the wanted CTCSS tone. IC603 contains the tone determining portions of the combination, and IC604 contains the necessary amplifiers for the filter arrangement. If the received tone is the proper one, as determined by IC603, it will be present in the output of the IC603--IC604 combination. This tone then passes to

IC605, which is a detector circuit that detects the presence (or absence) of a tone signal.

The IC605 output is normally high, and goes to a low voltage upon receipt of tone. This output appears at terminal K, which connects to the corresponding terminal K on the receiver chassis, and is used to disable the receiver audio section when no tone is being detected.

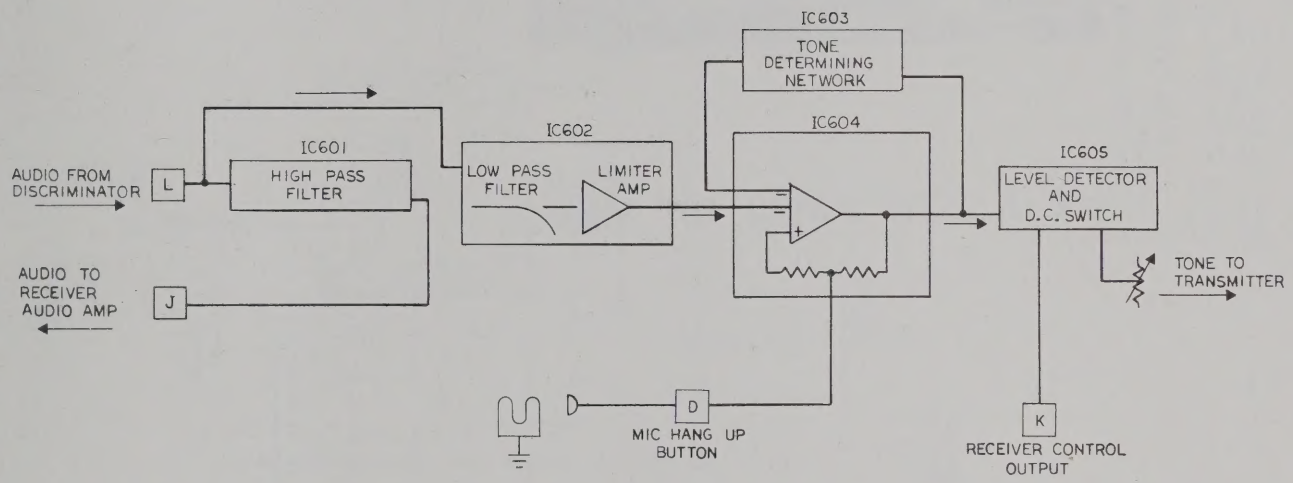
6-3 TRANSMITTING-MONITORING CONDITION

Both the block diagram and the full circuit diagram show a terminal point D, which is used to switch the system from the "receive" condition to the "transmit-monitor" condition. When point D is grounded, the system is in the "transmit-monitor" condition. The grounding and ungrounding of point D is accomplished in various ways, depending upon the particular installation. In base station installations, point D is grounded when the monitor key on the desk microphone is in its normal up position.

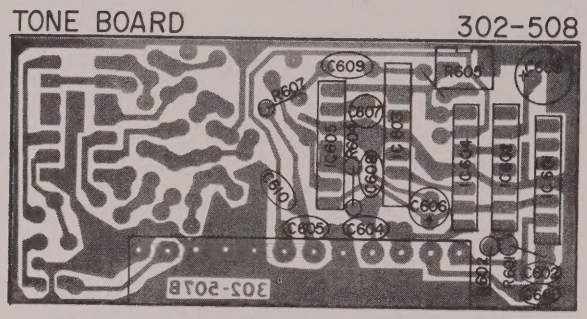
When point D becomes ungrounded, the ungrounded condition is sensed by circuitry inside IC604, and the gain of the operational amplifiers in IC604 is increased greatly so that the combination of IC603 and IC604 becomes an oscillator, with the frequency of output being determined by IC603. The oscillation is sensed by IC605, the level detector, and IC605 provides its high and low outputs, just as it would if it were receiving an incoming tone signal. Pin K goes low, permitting the receiver audio system to operate. In this condition, the radio receiver will hear any signals on the channel regardless of whether or not they have the proper CTCSS tone. This is the "monitoring" condition, which happens to be the same as the "transmit" condition, insofar as the tone system is concerned.

The oscillation output of IC603, IC604 is fed to F, and thus to the modulation section of the transmitter. When the transmitter is activated, it is modulated by the CTCSS tone.

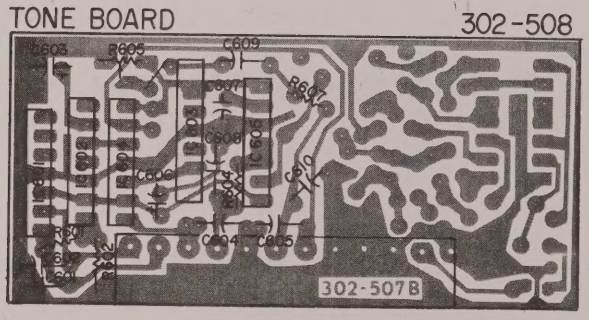
The amplitude of the tone voltage sent to the transmitter is controlled by R605, which is the control for adjusting the amount of modulation deviation caused by the tone. After the transmitter has been adjusted for proper modulation deviation on speech, according to the instructions given in the transmitter tuning procedure, R605 should be set to provide tone modulation deviation of plus and minus 750 Hz, (or less, depending upon the radio system).



6-4 TONE MODULE BLOCK DIAGRAM

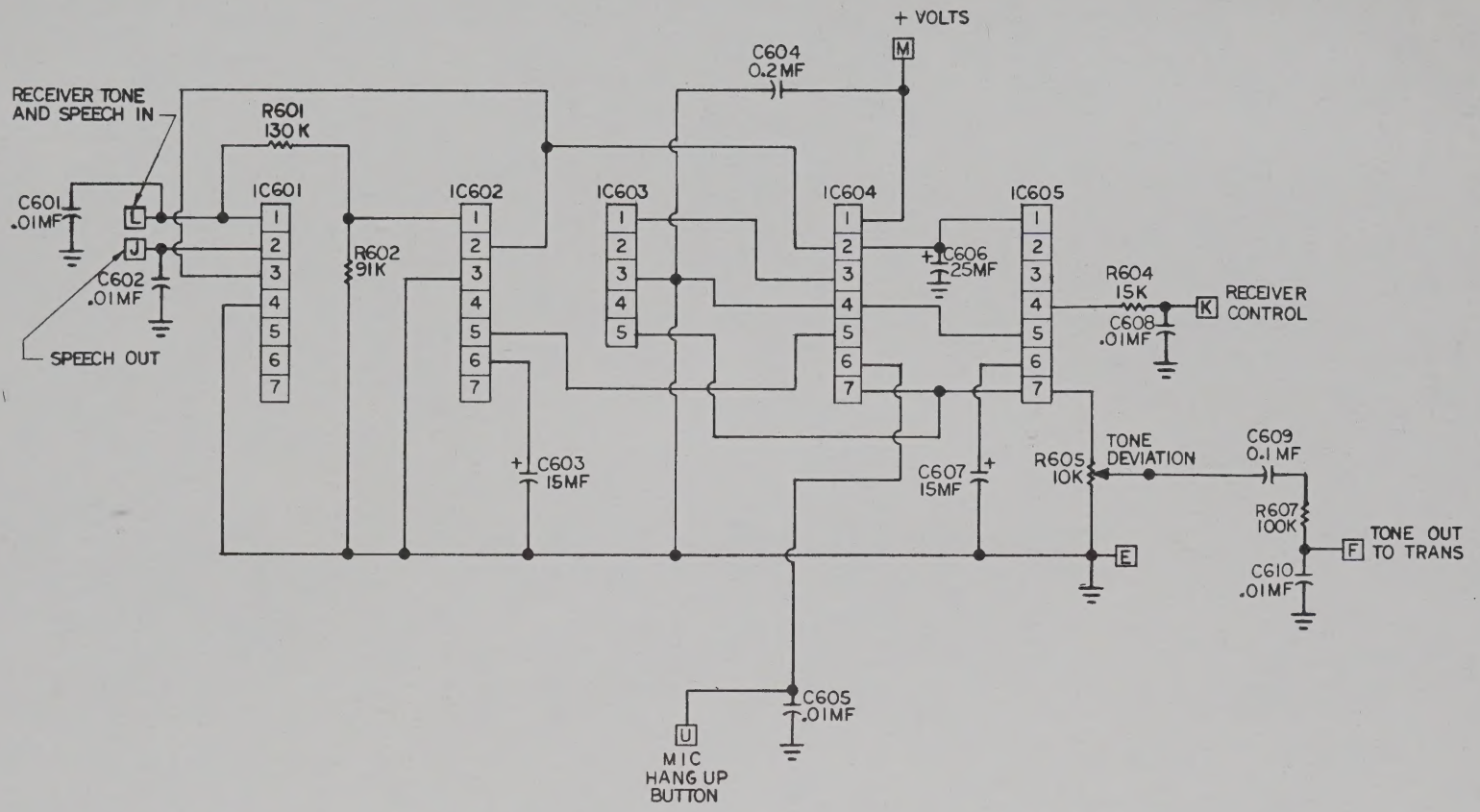


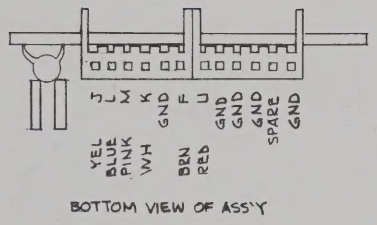
6-5 TONE BOARD TOP VIEW



6-6 TONE BOARD BOTTOM VIEW

6-7 TONE BOARD SCHEMATIC





BOTTOM VIEW OF ASS'Y

NOTES

1. ALL CAPACITOR VALUES NOT SPECIFIED OTHERWISE ARE PICO FARADS.
   ALL RESISTOR VALUES NOT SPECIFIED OTHERWISE ARE OHMS.
2. REFER TO DRAWING 700-215 FOR BASIC RADIO SCHEMATIC
3. LETTERED BOXES ARE CONNECTION POINTS TO DRAWING 700-215

6-8 TONE ENCODER-DECODER BD. 302-508

ITEM	DESCRIPTION	PART NO.
	RESISTORS	
R601	130K, 10%, ¼W	4701-0134-032
R602	91K, 10%, ¼W	4701-0913-032
R604	15K, 10%, ¼W	4701-0153-042
R605	10K, Trimmer	4751-0103-002
R607	100K, 10%, ¼W	4701-0104-042
	CAPACITORS	
C601	.01 mfd, +80-20%, 12v (DISC)	1502-0103-006
C602	.01 mfd, +80-20%, 12v (DISC)	1502-0103-006
C603	15 mfd, ±20%, 10v (TANT)	1515-0150-002
C604	.2 mfd, +80-20%, 12v (DISC)	1502-0204-006
C605	.01 mfd, +80-20%, 12v (DISC)	1502-0103-006
C606	25 mfd, 10v, 85°C (Electrolytic)	1513-0250-001
C607	15 mfd, ±20%, 10v (TANT)	1515-0150-002
C608	.01 mfd, +80-20%, 12v (DISC)	1502-0103-006
C609	.1 mfd, +80-20%, 12v (DISC)	1502-0104-005
C610	.01 mfd, +80-20%, 12v (DISC)	1502-0103-006
	INTEGRATED CIRCUITS	
IC601	I.C.	3133-5114-805
IC602	I.C.	3133-5114-801
IC603	I.C. (Specify Frequency)	3133-5114-804
IC604	I.C.	3133-5114-802
IC605	I.C.	3133-5114-803

ITEM	DESCRIPTION	PART NO.